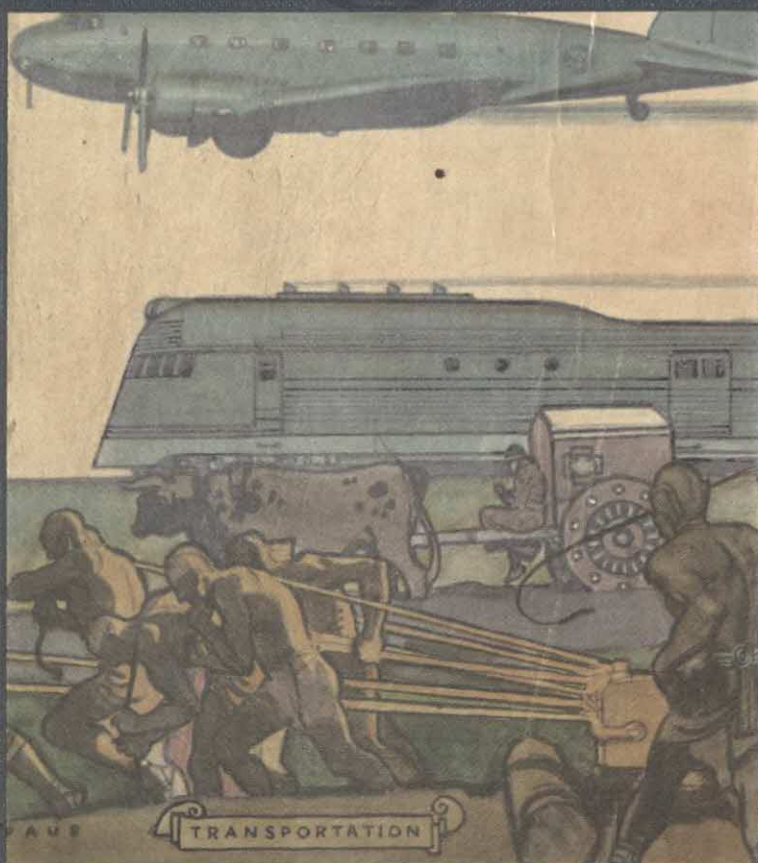


THE WONDERLAND OF KNOWLEDGE



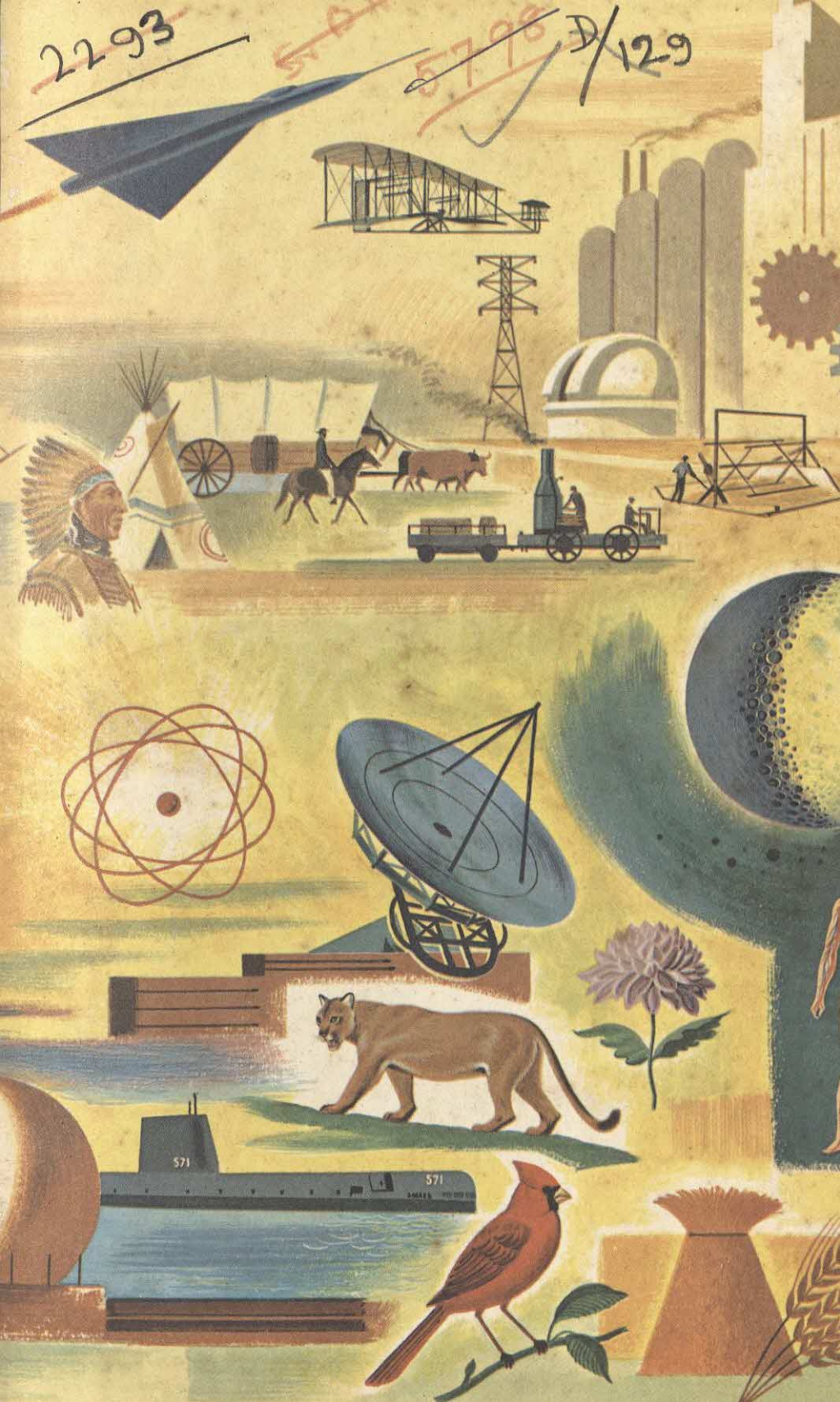
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THE WONDERLAND OF KNOWLEDGE



The Pictorial Encyclopedia



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PRONUNCIATION

The pronunciation of titles is indicated by accenting the word or by respelling it phonetically in italics. In the phonetic spelling, letters are used to indicate the sounds which they most commonly represent.

A vowel is *short* when followed by a consonant in the same syllable, unless the syllable ends in silent *e*.

A vowel is *long* when the letter occurs in a syllable which ends in silent *e* or when ending an accented syllable.

The hard sound of *c* is represented by *k*.

The hard sound of *s* is represented by *z*.

The foreign sounds which have no equivalent in the English language are represented as follows:

N for the French *n*, as in Breton: (**Breton**, *bre toN'*).

ö for the German ö, as in Göttingen: (**Göttingen**, *gö' ting en*).

ü for the German ü, as in Blücher: (**Blücher**, *blük'ur*).

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Ask *this Volume* ANOTHER!

How do fireflies or "lightning bugs" turn their lights on and off?

It is believed that fireflies turn the oxygen they breathe into energy in the form of light, rather than heat. This process is not well understood, but has been shown to have no connection with phosphorescence. See **FIREFLY**.

How could the United States save the cost of twenty battleships every year?

By preventing costly fires, this country could save about \$400,000,000 annually—enough to maintain the entire Navy Department for a normal year or build nearly twenty super-dreadnaughts at current prices. See **FIRE PREVENTION AND PROTECTION**.

What highly specialized equipment helps the flounder protect itself?

The flounder, so much esteemed as a food, can alter its mottled-gray color to imitate the sea floor on which it rests, by means of its extremely sensitive eyes. Sightless flounders cannot take advantage of the gift of adaptable protective coloration. See **FISH AND FISHERIES**.

What is the largest state of the United States, east of the Mississippi River?

The state east of the Mississippi having the greatest area is Georgia. See **GEORGIA**.

What relation between religion and war is indicated by some well-known national flags?

Many of the earliest flags had religious significance and several national flags were given added sanctity and prestige by the use of religious symbols. King Waldemar of Denmark is said to have seen a cross in the sky while he was engaged in battle in 1219; taking it for a good omen, he made the cross a national emblem. The early kings of France carried banners adorned with the cross of Saint Denis. The Union Jack of Great Britain bears the combined crosses of Saint George, Saint Andrew, and Saint Patrick. See **FLAG**.

What great painter hit upon some of the essential principles of modern airplane design 400 years ago?

Leonardo da Vinci, creator of *La Gioconda* (*Mona Lisa*) and *The Last Supper*, worked out theories of philosophy and mechanics far in advance

of contemporary thought. He believed that movement in the air could be affected by some device which would work like a screw (a propeller), and he also invented the first parachute. See **FLYING, STORY OF**.
Why is the English foot (unit of measure) just the length that it is?

King Henry I of England decreed that the yard should be as long as his arm and the standard foot should be one third that long. Since his arm measured thirty-six inches, the foot was set at twelve inches. See **FOOT**.

What move to permit labor to participate in profits startled the industrial world in 1914?

In 1914 Henry Ford revealed a profit-sharing plan whereby his employees would share in the distribution of twenty to thirty million dollars a year. He also announced a minimum wage of \$5 a day for Ford workmen. See **FORD, HENRY**.

What battle fought in New York state has long been considered a turning point in world history?

The Battle of Saratoga, in the American Revolutionary War, prevented the union of three British armies and the cutting off of the northern colonies from the southern. The American victory enabled the colonists to continue the war and encouraged France to come to their assistance. See **FIFTEEN DECISIVE BATTLES**.

How do great forests induce rainfall?

The shade of the close-growing trees over a large area lowers the temperature of the atmosphere close to the ground, thus keeping water vapor in the air. See **FORESTS AND FORESTRY**.

How does Uncle Sam protect the government's hoard of gold bullion?

United States gold is stored in an underground granite vault at Fort Knox, Ky., where it is guarded by a thick steel and concrete wall, a twenty-ton door, a bomb-proof roof, electric wiring, and machine-gun outposts. See **FORT KNOX**.

What forms of defense proved impractical in modern warfare?

The great Maginot Line fell during World War II and the Westwall proved useless; both were built for a war of defense whereas the contemporary war is one of action and rapid movement.



CONFLICTS *that shaped the* course of HISTORY



FIFTEEN DECISIVE BATTLES. The main stream of life and culture of the Western World has often been determined by a single armed conflict. Battles are not necessarily just an event in a war; they may turn the tides of politics, art, literature, and language of a people by either preserving the existing forms or allowing a new and strange culture to replace the old.

Decisive battles, then, are those which have had important effects on the history of the world. Sir Edward Creasy, the English historian, selected what he believed were the important battles in *The Fifteen Decisive Battles of the World*, which was written in 1851. Since that time other important battles have taken place which will some day undoubtedly find their way into a new and longer list. Such a list would probably include Gettysburg in the American Civil War, Sedan in the Franco-Prussian War, Mukden in the Russo-Japanese War, and battles in both World Wars.

Creasy's list of decisive battles is:

(1) **Marathon**, 490 B. C. Here the Greeks defeated the Persians and prevented the spread of the Asiatic civilization to Europe.

(2) **Syracuse**, 413 B. C. The Athenians were defeated in the conquest of Sicily, checking Greek rule in the West.

(3) **Arbela, or Gaugamela**, 331 B. C. European culture found its way into Asia with the defeat of Darius by Alexander the Great.

(4) **Metaurus**, 207 B. C. In this battle Rome defeated Hasdrubal, brother of Hannibal, destroyed Carthage, and checked the North Africa movement into Europe.

(5) **Arminius**, A. D., 9. A German chieftain, overthrew the Roman general Varus, ending Roman supremacy in Northern Europe.

(6) **Chalons**, 451. Theodoric, the Visigoth, and Aetius, in charge of the allied Roman army, defeated the Huns, under Attila, saving Europe from general pillage.

(7) **Tours**, 732. Charles Martel, king of the Franks, defeated the Mohammedans and stopped their westward movement in Europe.

(8) **Hastings**, 1066. In this battle William the Conqueror, a Norman, wrested control of England from the Saxon rulers.

(9) **Orleans**, 1429. Joan of Arc met the British at Orleans, defeated them, and made possible the freedom of France.

(10) **Armada**, The, 1588. When the English



HAUGHTY SPAIN'S SPECTACULAR DEFEAT

In 1588, King Philip of Spain sent a huge Armada—hundreds of ships—to conquer England. British ships, manned by plucky seamen, routed the great fleet in a fierce battle.

defeated the Spanish Armada, they destroyed the sea power of Spain and checked Spanish designs on England.

(11) **Blenheim**, 1704. The British Duke of Marlborough and Prince Eugène thwarted the schemes of Louis XIV.

(12) **Pultowa**, 1709. Here Peter the Great defeated Charles XII of Sweden, thereby making possible the establishment of the Russian Empire.

(13) **Saratoga**, 1777. General Gates's defeat of General Burgoyne at Saratoga turned the tide of the American Revolution.

(14) **Valmy**, 1792. The continuance of the French Revolution was assured at Valmy when the Allied forces under the Duke of Brunswick failed to advance on Paris.

(15) **Waterloo**, 1815. With Napoleon's defeat at Waterloo, the threat of French domination of Europe was decisively ended.

FIG. Long before the founding of the Roman Empire, this delicious, sweet, seedy fruit was cultivated in Asia Minor and along the Mediterranean shores. Today its popularity has spread throughout the world, and for the past two centuries it has been grown in America in the Southeastern

Atlantic and Gulf states, and in California, which leads in its production. In its native habitat, the fig is commonly used as a fresh fruit, but until recently it was known in the colder climates only in its dried form. Figs are now canned or shipped fresh to all parts of the country. The dried fruit is more than fifty per cent sugar and contains a large amount of protein, which gives it a higher fuel value than meat. It also has a mildly laxative effect.

The fig tree grows from fifteen to thirty feet high. What we call the fig is not a true fruit, but the growth of the end of the stem into a pulpy mass containing a cluster of tiny golden seeds. The fig is next to the wood, and is most abundant on new stems. Sensitive to frost, the tree is seldom raised in the North except as an indoor decoration or greenhouse product. It belongs to the mulberry family and is a relative of the

India rubber tree and the banyan tree, with its rooted branches.

Inasmuch as the flowers of the plant are contained within the fleshy so-called fruit, fertilization of the plant is difficult, for the pollen cannot be transplanted by ordinary wind and insects. Consequently, a special method of fertilization, called *caprifigation*, is used. Branches of the wild *capri* fig in blossom are tied to the tops of domestic trees. These blossoms attract an insect known as the fig wasp. As it seeks a place to deposit its eggs, it gathers the pollen from the blossoms and carries it to the blossoms of the cultivated trees. This is the only method by which the Smyrna fig, one of the favorite varieties, can be produced, and it was necessary to import the capri fig and the wasp before Smyrna figs could be grown in California.

FIJI, *fe'je*, ISLANDS. Formed by volcanic action, the Fiji Islands are a group of several hundred small islands in the South Pacific Ocean. Only about one hundred of the mountainous islands are inhabited. The total area of the group is more than 7,000 square miles.

The soil of the Fiji Islands is very fertile and the native farmers produce large crops

of tobacco, sugar cane, rice, pineapples, and bananas. Exports include sugar, coconut oil, copra (the dried kernels of coconuts), gold, and various fruits. The islands are rich in timber, and lumbering is important. The people are chiefly engaged in farming.

The Fiji Islands were discovered by Tasman in 1643, and, since 1874, when they were ceded by the Fiji chiefs, they have been a colony of Great Britain. Rotuma, an island north of the Fijis, was annexed in 1881. A governor, appointed by the British, rules the islands with the help of an executive council and a legislative assembly in which the natives are represented.

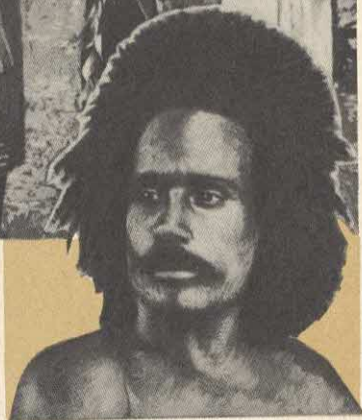
Only two of the islands are of large size, Vanua Levu and Viti Levu. On the latter is located the city of Suva, the capital. The bushy-haired, dark-skinned natives are of medium height. Indians, imported to work on sugar plantations, outnumber the native Fijians in the total population of about 295,000.



(2) Courtesy Raymond Whitcomb

HIGH SOCIETY IN A TROPIC PARADISE

Fiji Islanders, famous as the carefree people of a sunny land, are less backward than many South Sea races, at least socially. The women are far better off, having unusual freedom and influence. (1) A girl beating tapa bark. (2) Fiji Island debutantes. (3) A Fiji gentleman of high rank.



FILLMORE, MILLARD (1800-1874). One of the most sincere and honest men prominent in American politics was Millard Fillmore, thirteenth President of the United States. No wars and few political events of

importance occurred during his administration; but as a fair-minded executive, interested in the welfare of his country, he stands out above many others who have held high office. The fact that even his political enemies paid tribute to his high character is an honor that many may well envy.

Unfortunately, Fillmore never had the opportunity to bask in the widespread national recognition which is usually achieved by a Presidential candidate during a campaign. As Vice-President, he succeeded to the Presidency when Zachary Taylor died in 1850, and served the remaining three years of the term. Although he sought the nomination in 1852, by signing the Fugitive Slave Law and attempting to enforce it, he had lost the support of his own party. The Northern Whigs loudly condemned any action which favored the slave states.

Early Life and Education. Fillmore is one of the men who have proved the American idea that any boy, whether born in a log cabin or a mansion, may grow up to be President. There is a rather close analogy between the lives of Lincoln and Fillmore. The first home Millard knew was a small farm on the site of what is now Summer Hill, N. Y. But not for long was even this the Fillmore home. It was lost through

some difficulty over the title, and the family had to move to uncultivated wooded land nearby, where the boy worked until he was fourteen.

Poverty kept him from attending school;

and as soon as he was old enough, he was apprenticed to a wool carder. Disliking the work, he purchased his release as an apprentice when he was nineteen and secured a place with a lawyer, with whom he studied law. In 1823, though not well prepared, he was admitted to the bar; and while still a young man he was recognized as one of the leading lawyers in the state of New York.

Political Career.

In 1828 Fillmore was elected an Anti-Mason representative to the New York legislature. Four years later, as an ardent Whig, he was sent to Congress,

where he served for several terms. There he came under the influence of Clay, Webster, and Calhoun, who became his friends. However, the New Yorker clung to independent thought and did not hesitate to oppose Clay when the latter favored the establishment of the National Bank in 1842. In that same year, as chairman of the Ways and Means Committee, he helped to frame a major protective tariff act. Fillmore ran for governor of New York (1844), but was defeated. However, in 1847 he was elected comptroller of New York state. In the next year he was nominated for Vice-President at the Whig national convention, and was elected with Zachary Taylor, who died a year after taking office.



MILLARD FILLMORE

Thirteenth President of the United States
Administration, 1850-1853.

Reaching office through the death of Zachary Taylor, Fillmore served only three years. He displayed a policy of moderation throughout his administration in an effort to avoid conflict on problems of states' rights and secession.

His Administration. As President after Taylor's death, Fillmore's first significant move was the appointment of a strong Cabinet, headed by Daniel Webster as Secretary of State. He immediately signed the Fugitive Slave Law and the Compromise of 1850, which had been supported by his old friends. With the Whigs in the minority in Congress, most of the legislation suggested by the President fell on deaf ears. The Senate did, however, approve the trade treaty with Japan. Postage rates were reduced from five to three cents, and construction was begun on the railroad to the Pacific.

As for foreign policy, Fillmore remained aloof, although Webster offered some support to Louis Kossuth, a revolutionary leader of Hungary. Of note, also, is the fact that, during the third year of his administration, Harriet Beecher Stowe published *Uncle Tom's Cabin*, which did much to arouse sentiment against slavery in the Northern states.

As Ex-President. Fillmore failed to be nominated for another term. He was, however, nominated in 1856 and ran against Buchanan; but the weakened Whig party carried only one state. Realizing that his career in Washington was ended, he retired from public life and returned to Buffalo. There he lived until his death in 1874, maintaining until the last an interest in public affairs.

FINCH. Grosbeaks, redpolls, crossbills, buntings, juncos, sparrows, goldfinches, and many other birds belong to the very large finch family. All these small birds have the common character of a short, more or less stout bill especially adapted to crush seeds, which form the greater part of the diet of most species, although they eat some insects, buds, and fruit. Many European members of the family are popular cage birds.

The common birds of North America usually called by the name of finch are the *purple* finch in the East and the *house* finch in the West. They are birds about the size of the English sparrow, generally grayish



"SPARROW" OF THE NORTH

The Aleutian finch abounds in sub-Arctic areas.

brown in color, but with considerable crimson-red about the head, throat, and rump of the male. The house finch likes the vicinity of dwellings, often building its nest in crevices of houses or outbuildings. It is fond of fruit and is sometimes a pest, but on the whole does good in destroying seeds and some insects. It is resident in Oregon and Idaho south to Mexico.

The *purple* finch, on the other hand, is not so well known because it usually stays in the tops of trees, although sometimes it will become a familiar garden bird during the nesting season. It builds a nest of twigs, grasses, and rootlets lined with hairs, usually in evergreen or orchard trees, and lays four to six green-spotted eggs. Its song is a short, sweet warble. This species migrates to some extent, breeding north to Southern Canada and wintering from Connecticut and Illinois southward to the Gulf of Mexico. It has a habit of eating the buds of trees and in this way sometimes damages orchards, but is not very injurious.

Other less important finches occur in Western United States.

FINE ARTS. It is through the fine arts that man is able to express his deepest



(1) Courtesy Popular Mechanics

FINGERPRINTS TRAP THE CRIMINAL

The patterns of lawbreakers' fingers catch them. (1) Micro-photographs reveal the print's identity. (2) Preparing a mirror for print photography. (3) Developing prints. (4) "Signature."

thoughts and emotions and to satisfy his desire for beauty. The fine arts developed early in the history of man, and the crude drawings on the walls of caves were expressions of artistic desires of the cave dwellers. Man has always turned to art in times when the business of daily life is completed. Art, instead of being an imitation of nature, is rather the artist's impressions of nature. The highest forms of art are architecture, sculpture, painting, music, and poetry. See each of these under its own heading.

FINGERPRINT IDENTIFICATION.

It has become accepted as true that the minute lines on the inner surfaces of thumbs and fingers are not exactly the same on any two persons. Considering the countless millions of people in the world, this is

an astounding statement, but there has been sufficient proof of this individuality to justify officers of law in reposing confidence in fingerprint identification in their relations with criminals. A much-used system of bodily measurements, called the *Bertillon system*, is admittedly imperfect, because of chances of error and possible slight changes in physiognomy due to disfigurement, but it has been established that fingerprints of a person do not change.

Today, in all cities, when persons are placed under arrest they are not only photographed in front and side positions, measured and described, but they are fingerprinted, the thumbs and fingers of both hands being recorded. The prints are carefully filed for future reference, and photo-

graphs of prints of notorious people may be sent to hundreds of police departments, particularly when a fleeing suspect is sought over a wide area.

The process of taking these prints is simple; it is accomplished by pressing the fingers firmly upon the damp surface of a common black-ink pad and then transferring the hand to the surface of white paper and exerting pressure upon it.

The silver-nitrate method of raising latent fingerprints from paper, cloth, and rough wood, even revealing a print made through a glove, has increased the effectiveness of fingerprint identification.

The United States government has the fingerprints of millions of Americans on file in Washington. This file aids the police of the states and cities by serving as a national clearing house of criminal identification. Many of the prints, however, have been submitted by people of good character who consider the system a protection in case of amnesia, kidnapping, death, impersonation, or injury, while away from home. Other agencies using fingerprint identification are companies renting safe-deposit vaults, insurance companies, executors of wills, and other private businesses where identification involves the transfer of funds.

FIN'LAND. This Baltic country is situated in Northwestern Europe between Russia and the Scandinavian Peninsula. Its southern end, a peninsula, is washed by the Gulf of Finland, and at the north the country looks out on the Arctic Ocean. The Gulf of Bothnia is on the west. Finland is inhabited by a hardy, energetic people distinguished by love of freedom, courage, and a sense of honor. They speak a language related to the Hungarian.

In 1809, Finland became an autonomous grand duchy of the Russian Empire. Discontented with their vassalage to Russia, the Finns declared their independence in 1917, after the Bolshevik revolution, and in 1919 set up a republic under a Constitution. For 20 years they developed their country under an orderly and progressive

government. Then, in 1939, Russia attacked Finland, exacting 16,173 square miles in 1940. The Finns joined Germany as an ally in 1941 and recovered part of this area, but in 1944 they were forced to surrender to the Russians and the British. By the terms of the peace treaty, Finland returned to its 1940 boundaries and also ceded to Russia the Petsamo region on the Arctic Ocean.

After the peace treaty of 1944, the Finnish republic was left with a total area of 130,160 square miles, much less than its original area. The terms imposed in 1940 gave the Soviet Union Finland's defense area in the east, a valuable industrial section on the Gulf of Finland, the Finnish part of the Karelian Isthmus, and other sections in the north. The Petsamo region, lost in 1944, is rich in nickel; its loss cut off Finland's access to the Arctic. The population is about 4,050,000.

Geography and Industry. A flat country, except in the northwest, Finland is a land of lakes, swamps, and forests. In the north the winters last eight or nine months and the sun is never seen in December and January. Less than ten per cent of the soil is tillable, but the Finnish farmers have made the most of what they have. There is sufficient meadow land to support a prosperous dairy industry. Butter and cheese are exported. The chief farm products are hay, potatoes, oats, rye and barley.

Forestry is the leading industry. Under normal conditions, sawmill products and wood pulp and paper form the bulk of the exports. The fishing industry is also important, and fish is an item of export. Textiles, machinery, and other manufactured goods have to be imported, along with flour and coffee.

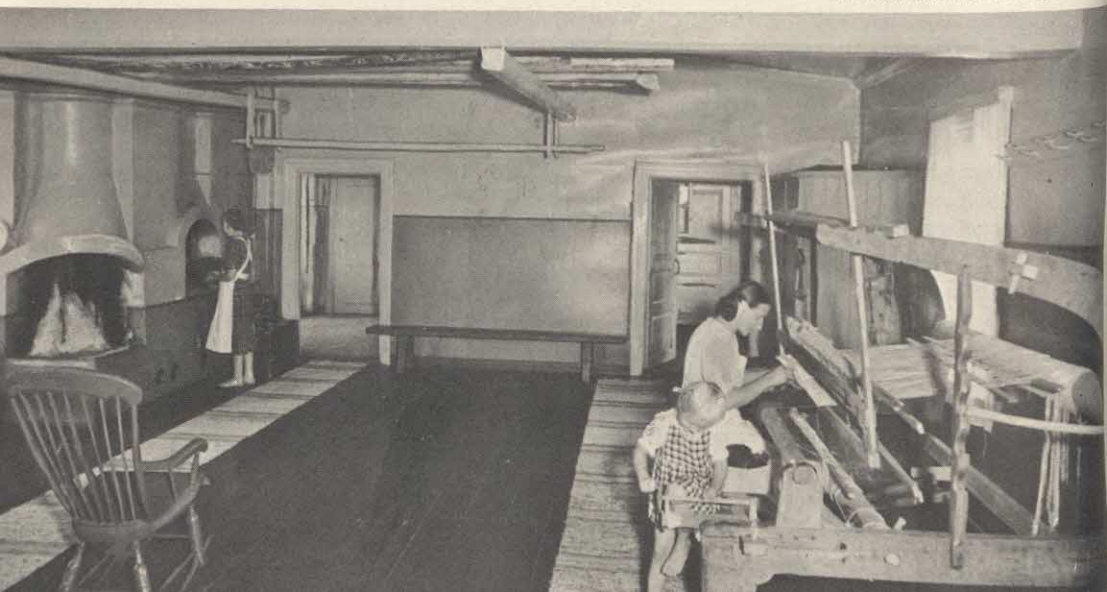
Finland possesses large quantities of iron ore, copper, and granite, and the mining and quarrying of these minerals have been undertaken successfully. In the far-northern part of the country are valuable nickel deposits, which were developed with foreign capital.



THE FINNS—A PEOPLE WHO LOVE SIMPLICITY AND NATURE

Finns have made the most of their cold country by hard work. They are great skiers, skaters, and swimmers. Although they have modern cities, Finns live close to nature and have no desire to get far away from it. They excel in architecture and plastic and applied arts. The dominant note is simplicity. They therefore transferred easily from folk art to modern art and are masters at it. Upper left, the clean, uncluttered lines of this church leave nature the supreme decorator. Upper right, log sorters at work. Timber is Finland's greatest resource. Below, the great all-purpose living room of a Finnish farm home.

Finnish National Travel Office



History and Government. The Finns, after centuries of life as an independent tribe, came under the control of Sweden in the twelfth century. Russia looked with favor upon the country of the Finns and tried to take it many times, but it was not until 1721 that it was able to annex a large territory. After continuous warfare Russia managed to capture the entire country from Sweden in 1809. Although Finland became a grand duchy of Russia, it was allowed to keep old laws and liberties. In 1897, however, the situation changed, and the strict rule that followed resulted in a series of uprisings that forced a return of the privileges of home rule. Nevertheless, Russia retained control of the Finnish parliament.

The Finnish House of Representatives declared Finland an independent state on December 6, 1917, but the republic was not firmly established until 1919. Civil war between the White Guards and Red Guards, who favored a Bolshevik government, ended early in 1919, when the conservatives, aided by German troops, drove the Bolsheviks from the country. A Constitution was adopted in July, 1919. It provides for a President, who is elected for a six-year term; and a Parliament consisting of one chamber of 200 members. The capital is Helsinki, a fine, modern city on the Gulf of Finland. Finland was the only European nation to make continuous payments of her debt to the United States.

After the outbreak of the Second World War in 1939, the Soviet Union forced the small Baltic countries to conclude treaties of non-aggression, in order to secure military and naval bases for the protection of Western Russia. Demands on Finland threatened that country's security and independence. Upon the refusal of the Finnish negotiators to accept the proposals, Russian forces invaded Finland on November 30, by land, air, and sea.

The Finns fought bravely against overwhelming odds, but were forced to surrender on March 13, 1940. When the Germans invaded Russia in 1941, the Finns fought

with them and regained part of their lost territory. However, they were forced to surrender in 1944; relations with Germany were broken off on September 2 and the peace treaty was signed on September 19.

FINNAN HADDIE. See HADDOCK.

FINS. Using their fins in the same way that a man uses oars to row a boat, fishes are able to balance themselves and at the same time regulate the speed of their movements through the water. So placed that the fish is able to move in any direction, fins are of different sizes and shapes, and consist of a thin membrane attached to a small, bony, fanlike framework that projects from the body. There are usually only two breast fins, and they are located immediately behind the gills. Their apex is toward the tail, and when the fish is resting they are drawn close to the body. The terminal fins are smaller than the breast fins, and are located under the throat and stomach. They point backward and downward and sometimes have long appendages.

The back fins point upward and vary in number from one to four. Some fish, such as the mackerel, have several little fins in addition to the back fins. The tail fin helps both to steer and to propel the fish through the water. The type and location of the fins vary for the different kinds of fish.

FIORD, or FJORD, *fyord*. Inlets of the sea which are long, narrow, and usually very deep, are called fiords. They are most numerous along the shores of Scandinavian countries, and their steep sides and spectacular beauty attract many visitors. A peculiarity is that they get deeper farther inland from the mouth. There is no fully satisfactory theory as to how they were formed. Glaciers moving southward from the Arctic regions in the geologic ages may have scooped out the coast line, forming inlets which were filled by the sea. In some cases, the sinking of the coast line may have allowed the sea to flow farther inland.

In North America there are many fiords along the shores of Maine, and in British Columbia and Alaska. Similar inlets are the sea lochs of the British Isles.



THE LIGHT OF THE WORLD

Fire is so necessary to man that for centuries he worshiped it. Here is a primitive "match."

FIR, *fur*. In the Northern Hemisphere there are about forty kinds of firs, a genus of evergreen trees called *Abies* by botanists. Many firs grow in the United States and Canada, particularly in the great mountain ranges of the West. Some species also flourish in areas in the East. The trees are tall, shaped somewhat like a pyramid, and the cones are rarely borne anywhere except near the top. The cones are from two to nine inches long, rather oblong-cylindrical in form, and are decidedly distinct in that they stand erect, like candles on a Christmas tree, in the topmost branches. The mature cones are often so heavy that the tops of the trees are broken off by severe winds.

As a rule the limbs of fir trees do not extend far from the trunk, and the tops of the trees have a pointed appearance. The western firs grow much larger than their eastern relatives. Some reach a height of 250 feet and a diameter of six feet.

The wood of some firs is used in paper-making. Fir lumber also goes into building construction, packing cases and boxes, flooring, and interior trim. Some species are very popular as ornamentals and are planted by property owners for that pur-

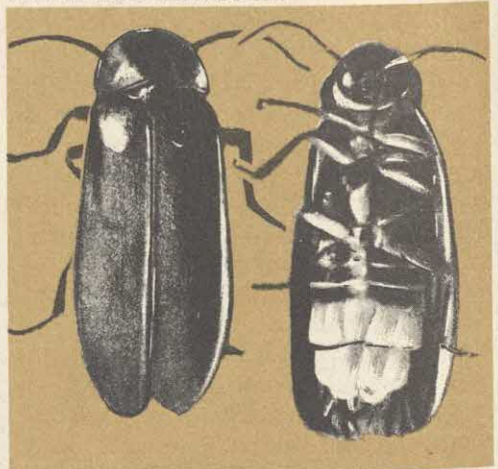
pose. Canada balsam, from the balsam fir, is used in medicine. The so-called Douglas fir is not a true fir. See **BALSAM FIR**; **CONIFERAE**.

FIRE. To the ancient Greeks, fire was one of the major elements, along with the earth, air, and water. Some early philosophers even went so far as to say it was a basis for animal life. However, now science treats it as a product of combustion. Primitive man first saw fire in volcanoes, lightning, and perhaps in forest fires. It was something to be feared, and, like everything which he feared, he worshiped it. Once he tamed it, however, a utility for warmth, light, and preparation of food was discovered. Fire was then cherished highly and great care was taken to preserve it.

Early man probably created flame by friction with a drill or flint. The Greeks relate, and the story has been retold in poetical form by Shelley, that Prometheus brought fire from the realm of the gods to man. Today, fire is the most important single factor in modern industrial life. Fire in its various forms still heats man's home and cooks his food, an indispensable part of civilized life. It is now defined as "the principle of combustion." See **COMBUSTION**.

FIREARMS. See **CANNON**; **MACHINE GUN**; **REVOLVER**; **RIFLE**; **SHOTGUN**.

FIRE DEPARTMENT. See **FIRE PREVENTION AND PROTECTION**.



NATURE'S MAGIC LANTERN

FIREFLY. This picturesque name is popularly applied to a beetle also known as a *lightning bug*. It has the true beetle character, even though its outer wings are not hardened quite so much as are those of other beetles.

There are several common kinds differing mostly in size, some being less than a half inch in length, others being nearly an inch. The striking fact about all these beetles is their light-producing power. Examination of any firefly will show that the tip of the body on the underside is of a light sulphurous-yellow color when seen by daylight. At night this area gives off light by flashes, glowing feebly between the flashes.

It was formerly thought that this light was phosphorescent, but it has been proved that it is not. It is produced by the oxygen taken in through the firefly's system of air tubes, or breathing tubes. The oxygen acts upon certain substances in the beetle's fat to produce the strange glow. Scientists think that the "fire" of the firefly is used as a means of attracting a mate.

Some fireflies are wingless and still produce light. These are called *glowworms*. Larvae or grubs of some fireflies produce light and are also glowworms. They are frequently seen in damp soil early in the summer.



Courtesy Popular Mechanics

*Warring on the
"RED DEMON"
—constant, costly
menace to
life and
property*

FIRE INSURANCE. See INSURANCE.

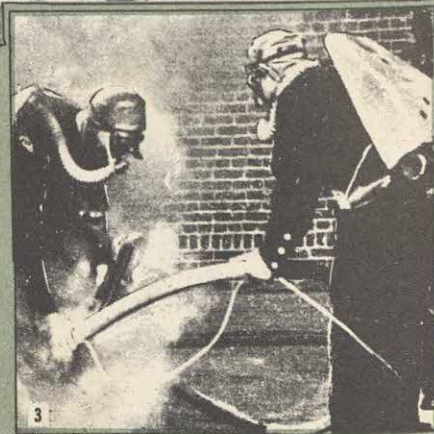
FIRE PREVENTION AND PROTECTION. Clang! Clang! People rush to their doors and out into the streets! The harsh bells and screeching sirens of madly speeding fire engines herald thrills which few can resist, whether they be housewives, workmen, business men, or school children. On come the red engines with the speed of lightning! They carry hose, long ladders, water pumps, and men whose faces are intent with the realization of the important and dangerous task before them. It is the duty of the firemen to fight something more powerful than man or animal, a form-

less monster hungry for anything it can touch—fire.

The Tragic Cost of Fires. Few who watch a fire ever think what that fire, and the ones that happen on an average of one a minute in the United States, actually mean each year. Annually, loss by fire costs America hundreds of millions of dollars—millions that could do tremendous good if spent on education, medical research, housing projects, or some other measure which would contribute to human welfare. Not only is money lost in fires, but there is loss of human life which cannot be measured in dollars and cents. Valu-

mated at \$350,000,000. The average yearly cost of fires to every man, woman, and child in the United States is \$2.50, an amount much greater than that for European nations. Yet the crowd on the street finds the neighborhood fire thrilling and romantic instead of horrible and tragic. After leaving a fire, each person should let that experience serve as a warning to study the causes of fire and what he can do to prevent fire, lest some day the monster strike closer to his own home, life, and pocketbook.

Causes of Fires. Lightning is often a natural cause of fire; but although it is out



Courtesy Popular Mechanics

SAVING WEALTH—AND LIFE

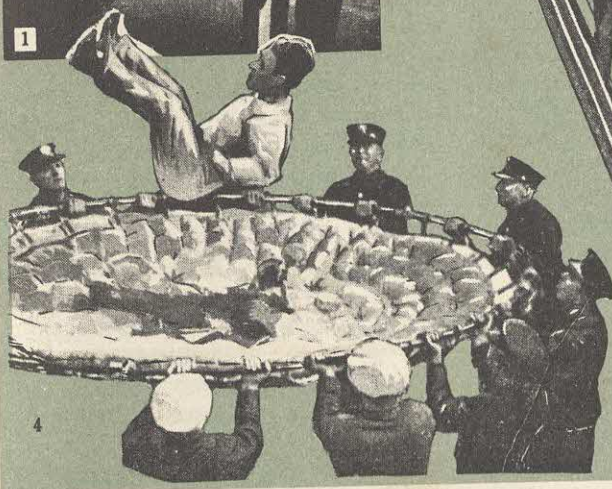
Firemen do much more than pour water on burning buildings. (1) A gas-masked squad rescues a victim of smoke. (2) Fighting a lumber-yard fire. (3) Rescuers at work during a blaze.

ables which cannot be replaced and records which have taken years of labor may be destroyed; and sometimes the cost of living is greatly affected.

The disastrous Chicago fire of 1871 caused a loss of \$196,000,000; the San Francisco fire of 1906 destroyed 520 blocks containing 25,000 buildings, causing a loss esti-

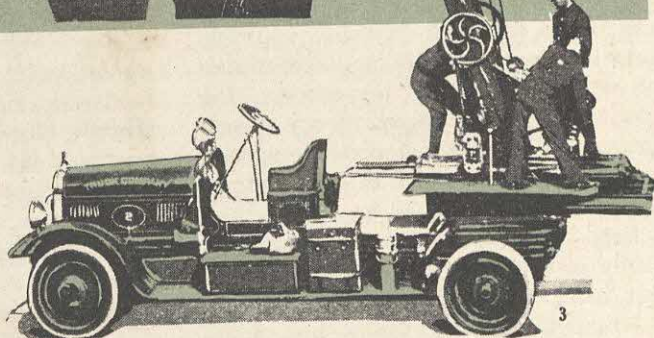


Courtesy Popular Mechanics



FIREMEN'S TOOLS

The grueling job of fighting a bad fire is immeasurably aided by adequate equipment. (1) Pulling the hose from the rear of an engine. (2) Up the tall ladder to a burning roof. (3) Motor-lifted extension ladders make "high altitude" work quick and safe. (4) The life net catches a man jumping from above.



of the control of man, much can be done to protect property against lightning by the use of rods to attract and ground the charges before they contact the building. Spontaneous combustion provides another dangerous source of fire, inasmuch as extreme heat among objects which can burn may cause them to take fire. Oily rags in the home, garage, or any other place where they are exposed to the air should be disposed of, as they frequently generate enough heat to become inflamed. Where very fine materials are concentrated, such as the dust of a flour mill, a violent explosion often takes place.

Undoubtedly the greatest fire enemy of man is man himself, for by his own carelessness he brings about major disasters. Many a building has been burned by an unthinking smoker tossing a lighted match or cigarette into rubbish. Even such an innocent task as answering a doorbell may cause a fire if the housewife has failed to shut off an electric iron. Careless handling of matches by adults and children is a recognized factor in producing fires; consequently, whenever possible, safety matches, which cannot be ignited except by a special striking surface, should be purchased. Much motion-picture and camera film is explosive, although now a safety film with burning qualities similar to paper has appeared on the market.

Fire Prevention. In talking of fire prevention, the old philosophy of locking the barn before the horse is stolen should be applied. Fireproof buildings should be constructed and provided with fire escapes. Brick and other masonry should be used in the walls, with as little wood as possible in the interior of the building. Fire escapes are metal stairways on the outside of a building, providing an emergency avenue of escape. They are particularly important if the building is too high to permit jumping to safety. The latest structures have enclosed fireproof towers and stairways, usually toward the rear of the building, with doors to keep out flames and smoke. A "chute-the-chutes" type of fire escape

has been used for schools; in this type of equipment, children slide down the escape.

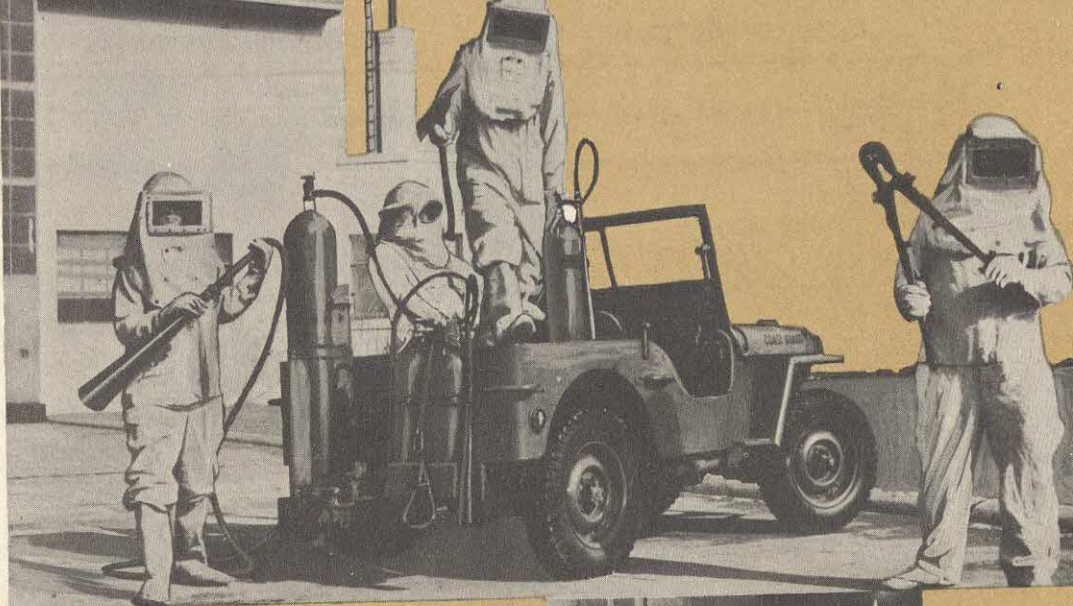
For ordinary protection, a surface covering of asbestos is the best fireproofing material available. Since the Iroquois Theater fire in Chicago in 1903, in which 575 people lost their lives, laws have been passed almost everywhere requiring asbestos curtains for theaters. No effective methods of fireproofing cloth have been found, although solutions of tungstate of soda or sulphate of ammonia are partially effective.

State and local laws, building codes, and systems of inspection have reduced the possibility of fires. Community campaigns, efforts of clubs, school programs, and fire drills are becoming more and more common and are of great help in the war against fire.

What to Do in Case of Fire. Human beings, like animals, often become panicky when confronted by fire. Running about and screaming often replace common sense and reason. One should remember never to call "Fire!" in a crowded place. The first thought of the individual should be to reach an alarm box so that help can be obtained to fight the fire. Alarm boxes, to be found in large buildings or at certain designated places in the neighborhood, generally have a small glass door which must first be broken or opened. Inside there is a handle, to be pulled or turned, which sets off a signal in the central station and in the nearest firehouse; the signal, by means of a number of gong strokes set off by the box, gives the approximate location of the fire.

Automatic alarms are often installed in buildings. When the temperature rises to a certain point, the circuit in the alarm is closed and a signal is given.

Simple Fire-Fighting Methods. Everyone should learn the simple means of fire fighting. Fires always should be attacked from the base, and water is the most effective weapon. In oil fires, however, the oil floats, and water serves only to spread it; smothering with either cloth or chemicals is the most effective method of extinguish-



*Walter Kidde Public Relations;
Photograph from U.S. National Museum*

The "Men from Mars" above are Coast Guard fire fighters, dressed in asbestos suits and outfitted with carbon dioxide fire extinguishers.

ing this type of flame. An ordinary blanket or woollen clothing may be sufficient to put out a small fire. Anyone whose clothing has caught fire should quickly wrap himself in a blanket or other available material, for even small body burns are often fatal.

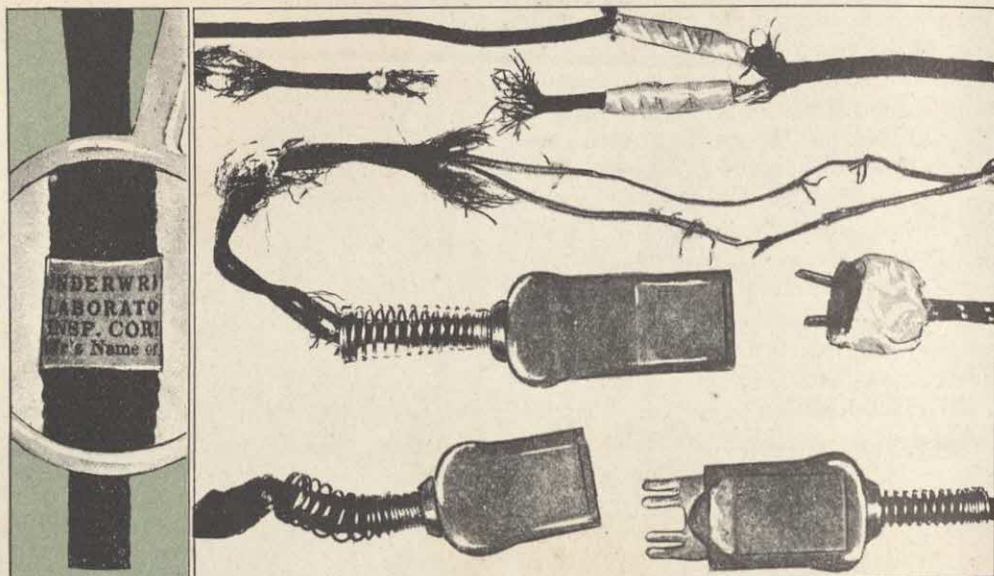
A door leading to a fire should be opened with great care, so that a draft will not draw the flames into another room. Always feel the door first to see whether it is warm. If very hot, it should not be opened unless absolutely necessary. When opening the door, proceed slowly, keeping a foot against it until the force and heat of the flame is determined. Sometimes just a door will serve to keep out a fire until a person has had the opportunity to construct a rope out of sheets or other material for escape through a window. In going from a burning room into a smoky hallway, a person should tie a wet towel over his mouth and should crawl along the floor, for there the smoke is thinnest.

Fire-Fighting Equipment. Even in the days of Nero, in ancient Rome, men were trained in the use of fire buckets and a kind of hand pump; but it was not until



after the disastrous London fire in the seventeenth century that the first extensive fire brigades for hand fighting were established. During the next century came companies which hired men as fire fighters and sold the service to the community. Fire societies in the American colonies were the first public fire-fighting organizations. It is interesting to note that George Washington was regularly enrolled among the volunteer firemen of Alexandria, Va. By the end of the eighteenth century, some forms of hand-drawn pumps and hose machines were in use, but regular public departments with paid firemen did not appear until the close of the nineteenth century.

A familiar sight a few decades ago were the wood-burning, horse-drawn pumps



Courtesy International Association of Electrical Inspectors

INVITATIONS TO DISASTROUS FLAMES

Faulty electrical wiring is a chief cause of fires in homes. Cords should never be allowed to fray. Left, the Underwriters' Laboratory "O.K." tag badge of safe wire.

which clanged down the street, spewing forth smoke. The fire department of today is a vast improvement over its predecessor of those days. In cities, the diversified, motorized equipment is well kept. Pumps of the modern type can produce as much as 1,500 gallons per minute with a pressure of 120 pounds per square inch. Water towers, working like large telescopes, can be raised to a height of seven stories and can shoot horizontal streams of water into a burning building.

Numerous types of ladder wagons are used, some hook and ladder machines measuring sixty-five feet in length and having ladder which can be extended upward eighty-five feet. Among the modern additions to the modern fire department is the electric-lighting truck with floodlights for use at night. Fireboats with pumps and nozzles for forcing streams of water are used on lakes and in harbors to combat fires in ships and in structures along the shore.

In New York City the fire department is composed of a staff of thousands, including hundreds of companies. These are

engine companies, hook and ladder companies, fireboats, rescue companies, searchlights, gas wagons, and ambulance companies. Firemen are chosen by civil service and are trained in special schools.

Most fireproof buildings have sprinklers in the ceilings. Partly made of soft metal with a low melting point, they allow the water to pour forth as soon as the heat of a fire melts the soft plug.

There are several kinds of common hand extinguishers. One type is filled with a solution of water and common baking soda, above which is suspended a bottle of sulphuric acid. The top of the bottle falls out when the extinguisher is inverted, and the acid then mixes with the soda solution, forming a gas which forces the water out through a short hose. For oil fires a container filled with carbon tetrachloride is used, which, when released, forms a blanket of gas and keeps air from reaching the flame.

Fire Underwriters and Insurance Companies. The National Board of Fire Underwriters has done much to decrease fires and fire hazards in the United States.

Their testing laboratories inspect building and wiring materials for safety and fire-resisting qualities, stamping with a seal of approval those articles which meet the requirements. The Underwriters publish fire-prevention data, support safety campaigns, and keep records and statistics on fires in the United States. Valuable also are the many insurance companies which make possible the protection of investments in buildings, homes, automobiles, and other property subject to fire. See ASBESTOS; FIRE; FORESTS AND FORESTRY; INSURANCE.

FIREWORKS. Young and old, the world over, for centuries have found pleasure in igniting fireworks and watching the fiery displays which can be produced so artfully by combining explosive powders and metals in various forms. Three thousand years before Christ, the Chinese had fireworks. The Greeks made use of a combination of powders which has come to be known as Greek fire. In Rome, festivals and celebrations of emperors were marked by displays of beautiful fireworks, and since that time they have played a prominent part in coronations and holidays throughout Europe.

In America, fireworks are used for holiday occasions, particularly associated with Independence Day, and in some parts of the country, with Christmas and New Year. Fairs and festivals of foreign groups usually have large showings ranging from large lighted pieces depicting scenes such as Niagara Falls and the Battle of Bunker Hill to Roman candles and skyrockets.

Fireworks are composed of gunpowder, charcoal, saltpeter, and other substances which produce a variety of effects.

In industry and war, fireworks are frequently used for signaling and light. Night signals on railroads are produced by torpedoes on the tracks or by colored fusees. Parachute flares are used in aviation to direct airplane landings on darkened fields.

FIRE WORSHIP. Primitive man often worshiped things he feared and did not understand. Fire was one of them. When he found use for the strange discovery he



UPI

FLASHING JEWELS IN THE SKY

Dazzling fireworks light up Notre Dame Cathedral and the River Seine when Paris celebrates Bastille Day.

was careful to preserve it, and his home life was built around the fire in the center of his hut. Passing the flame on to someone else or starting a new fire was usually accompanied with a ceremony. The forms of worship varied. Some paid homage to the physical properties of fire; others conceived of a fire spirit, or god, who lived in the flames and presided over them.

In early Egypt, Chaldea, and Assyria, rites were performed to the god or glory of fire. Even the Greeks and Romans had rituals. Recent examples may be found in native African tribes, the American Indian, Polynesians, and natives of parts of Mexico, where fire forms a very definite part of the religious ritual.

In modern public ceremony and religion,

fire still plays an important part in the rites. Hell has been conceived of as a blazing inferno. Churches and shrines contain burning incense, flickering candles, and braziers of fire, and monuments and sacred places sometimes maintain perpetual flames which are carefully tended so that they never die.

FIRST AID TO THE INJURED.

Ofttimes, with the nearest doctor dozens of miles away, some member of a group will break an arm, be suddenly stricken ill, suffer a painful cut, or otherwise be seriously injured. In such a case, a knowledge of first aid may save a life, or at least lessen the suffering until a physician can arrive. Everyone, therefore, regardless of his occupation, should have a working knowledge of first aid.

Learning First Aid. No organization makes greater use of first aid than the Red Cross, an organization acting in both peace and war to lessen human suffering, care for injuries, and assist in time of earthquakes, fires, and floods. For this reason, the teaching of first aid in the schools is generally supervised by the Red Cross. Pupils are always keenly interested in learning how to prevent and treat injuries, how to use simple medical equipment, and, if there is none at hand, how to improvise crude substitutes. Properly taught, first aid is like a game, and a highly interesting and useful one it is.

Boy Scouts and Girl Scouts are required to learn first aid, and must pass frequent tests for expertness in this art. Regular contests between troops of Scouts are held, the winning troop receiving a prize for speed and efficiency.

Mines, mills, and factories now spend large sums of money to train first-aid teams made up of workers. Not only does this create a good spirit between the management and worker, but it aids in cutting insurance costs and enables the teams to handle unforeseen emergencies with little confusion. Nearly every large plant has X-ray equipment, a small hospital, and even trained nurses in constant attendance.

General Instructions. Almost without exception, shock accompanies every serious accident. The patient is weak, his skin pale, and he often has a weakened heart action. He should be kept on his back, his head level with the rest of his body. Blankets, hot-water bottles, or heating pads can be used to keep the victim warm. If he is conscious and is not nauseated, he may be given a hot drink of coffee, tea, or water, in order to increase his internal warmth. One of the most important rules to follow is to avoid moving the person who is in shock. If unconscious, he may be stimulated with smelling salts.

Wounds. These may take a variety of forms, from a simple cut to large, jagged holes torn in the flesh. The most important step in treating any wound is to stop the victim's bleeding. Garments must be removed from the wound to prevent the contact of germ-laden clothing with the blood stream. Air will not ordinarily cause infection, but will assist in coagulating the blood.

Small wounds usually will stop bleeding after a short while; in the larger ones, where blood is flowing freely, the pressure method should be tried to stop the flow. Pressure points are shown on page 1492. Blood flows in quick spurts from an artery and can often be stopped by pressure on the spot where the artery crosses a bone. The steady flow of blood which results when a vein is cut may be stopped by bandaging a compress over the wound or by applying pressure near the edges of the wound until the compress can be obtained.

In an emergency, a tourniquet may be applied; but since its use can produce serious effects, it should be resorted to only when pressure methods fail. The tourniquet must always be loosened as soon as the bleeding stops, and the final closing of a wound should be left to a physician.

Fractures. Whether simple or compound, fractures of the leg should be "splinted" before any attempt is made to move the patient. Splints must be long enough to reach beyond the nearest joints,

to keep them from bending. By holding the limb stiff, a splint keeps the leg muscles from being punctured by shattered bone. Splints should be wide enough to project beyond the limb, so that the bandages that keep them in place will not press against the flesh.

Fractured arms are treated in a similar manner. When the elbow is free, the lower arm should be carried in a sling tied about the patient's neck, to prevent movement of the arm. The setting of any bone may be safely attempted only by an experienced physician.

If the collar bone is fractured, the arm should be carried in a sling and bound closely to the body to prevent movement.

Fractured ribs will cause least pain if the chest is tightly bandaged.

A fractured skull should be treated with cold cloths and loosely bandaged to prevent forcing the broken bone into the brain. A physician must be summoned immediately.

Sprains and torn ligaments should be soaked immediately in very cold water. After a few hours, the part should be bathed in water as hot as the patient can bear.

Dislocations. These occur when the bones slip out of place. They are usually accompanied by torn ligaments. No effort should be made to replace the joint. Get a doctor. Dislocated shoulders and elbows should be supported in a sling about the neck. The affected part should be bathed in very cold water.

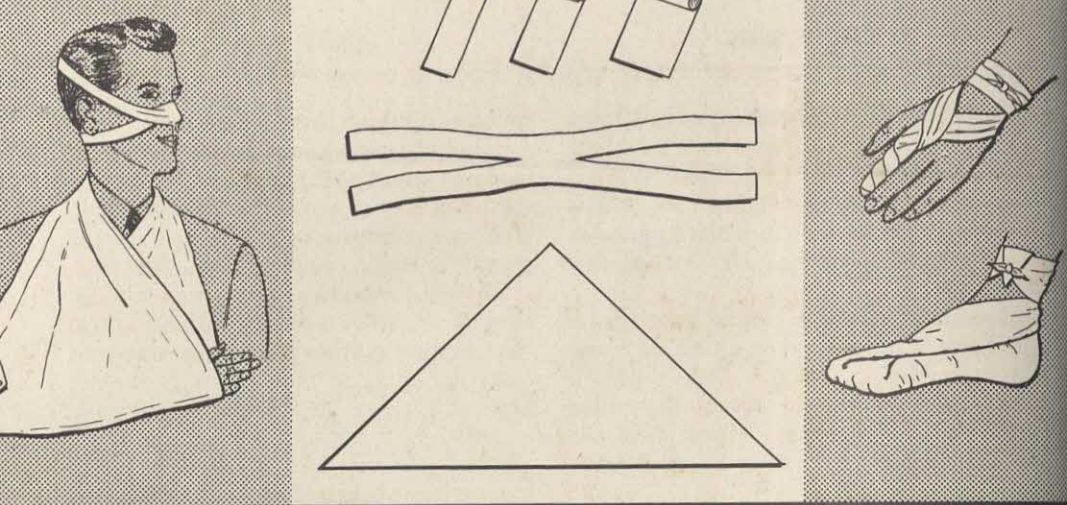
Unconsciousness. Shock, sunstroke, bleeding, heat exhaustion, fainting, freezing, drunkenness, poisoning, brain injury, and apoplexy cause unconsciousness. In sunstroke, drunkenness, and apoplexy, the patient's face is red and congested. This congestion is relieved by raising the head. In drunkenness, keeping the head cool and giving an emetic are also necessary. Apoplexy, often confused with drunkenness, is often accompanied by more complete unconsciousness and a partial paralysis. Sunstroke is accompanied by extraordinary body heat. The symptoms of heat exhaus-

tion are similar to those of fainting.

Poisoning may occur if the poison is taken by mouth, is inhaled, or comes into contact with the skin. The first step is to remove the patient from contact with the poisoning agent. If the poison has been swallowed the stomach and bowels must be cleared of their contents. This is done with emetics to induce vomiting and with cathartics to urge the bowels to empty. One of the best is called the *universal antidote*. In a prepared powder it consists of two parts activated charcoal, one part magnesium oxide, and one part tannic acid. However, it can be easily prepared from two parts crumbled burned toast, one part milk of magnesia, and one part strong tea. If the poison is inhaled the poisonous vapors should be identified, if possible, and the patient quickly removed to the fresh air. With unconsciousness, artificial respiration should be begun. For poisons in contact with the skin or eyes, a thorough flushing with water is necessary plus removal of any contaminated clothing and jewelry.

Information about poisons and poisoning can be obtained from *Poison Control Centers* located throughout the United States. These centers can tell the ingredients of many poisons that might be known only by a trade name, and the measures that should be taken in an emergency. Many of them operate on a 24-hour basis. They are often associated with the local health department or hospital and they can frequently be located through these agencies or the telephone operator.

Unconsciousness from an injury may be due either to shock or to concussion of the brain. Gunshot wounds often bring unconsciousness, though much of the bleeding may be internal. Fainting is a form of shock and is treated in the same manner as shock. Unconsciousness may also be the result of heart malfunction or stoppage. The best first aid method is *closed heart massage*. This is done by placing the heel of the hand on the patient's breastbone and then placing one hand on top of the other.



TYPES OF BANDAGES

Most injuries can be protected or supported with one of three basic shapes of bandages. The roller bandage (top center) is used in wrapping a finger injury. The bandage is simply wrapped and fastened around the injured part. The four-tail bandage (center) is used in various sizes for any wound, such as a nose wound, that requires a pocket-shaped bandage. The triangle bandage (bottom) can be tailored to fit a foot or to make a supporting sling. It may also be folded to form a cravat bandage, a long slender bandage with tapered ends.

Then with quick, firm thrusts push down hard enough to depress the chest and force some blood out of the heart into the big arteries. The hands are then lifted momentarily before being pressed down again. A rhythm of about seventy presses and releases should be established and continued until the patient regains consciousness, or other revival methods are available. The closed heart massage is used for shock, asphyxiation and any instance of heart stoppage.

Snake Bites. Bites from venomous snakes are always serious. A tourniquet should be placed above the wound to prevent spread of the poison in the system, and the wound should be slashed so bleeding will help wash it out. It is safe to suck out the poison if there are no cuts or cracks on the lips and mouth of the person giving the first aid.

Other Bites. Bites of rabid dogs should be washed immediately to remove all traces of the saliva. This should be done under running water. Iodine may then be applied and the patient taken to a doctor for the Pasteur treatment if it should be found necessary.

Mosquito bites may be treated with weak

ammonia, by bathing in a solution of baking soda, or by applying an anesthetic salve. The bites should not be scratched because they may become infected.

Electric Shock and Drowning. These are treated in somewhat the same manner. However, in electric shock, if the victim is still in contact with the power source, he should be carefully rolled or pulled away with a non-conductor such as a broom handle, or the power should be cut off. Once freed the victim may require revival by artificial respiration or by closed heart massage (see DROWNING).

Burns. Burns are classed according to the depth or degree. In *first degree*, the skin is reddened. In *second degree*, blisters develop. In *third degree*, there is deep destruction of the cells that form the new skin. The degree of a burn is often difficult to determine immediately, but if a large part of the body is affected there is danger of shock. The first aid treatment involves keeping air from the burned area with soft sterile cloths and treatment for shock. Small minor burns may be treated with salad oil, petroleum jelly, or a burn salve. Serious

burns should be protected and covered until medical help is available. If such help will not be available for more than twenty minutes, and the victim is losing body fluids, replacement fluids must be given to prevent shock. However, they should be discontinued if they cause nausea. At fifteen-minute intervals half-glass doses of a solution made by dissolving a half teaspoon of table salt

the blisters with a water paste made from shavings of laundry soap, which should be allowed to remain on the affected area overnight. Calamine lotion or baking soda compresses may also give relief. In severe cases, a doctor should be consulted for medical care.

Materials For First Aid. If prescribed first aid materials are not available when they are needed, makeshifts must be found.



PRESSURE POINTS

If a wound is such that the flow of blood prevents clotting, pressure must be applied. Direct pressure may be made on the wound with a clean cloth or gauze. Otherwise it is best applied to certain locations to lessen the blood flow to the wound. Pressure on the carotid artery relieves bleeding of head wounds. The subclavian artery pressure point is for head wounds. The brachial artery pressure point is for bleeding from the arms, and the femoral artery for bleeding from the legs. Only trained persons should use a tourniquet because misuse may cause tissue damage.

and a half teaspoon of baking soda in a quart of water should be given.

Sunburn is caused by overexposure to the ultraviolet rays of the sun or a sun lamp. For mild sunburn, cold cream or oils and greases may relieve pain. If blistering appears a dressing should be used and the blisters should not be broken. Medical care is necessary for extreme cases. No sunburned skin should be exposed again to the sun until there has been a complete healing.

Ivy Poisoning. Summer-long immunity to ivy poisoning is possible for most people with the use of special pills. However, the person who is exposed without immunity should be treated immediately. The skin should be washed thoroughly with laundry soap and all contaminated clothing removed.

If blisters have begun to form, they should be washed with a diluted solution of water and alcohol containing about 8 per cent ferric chloride. If this is not possible, treat

For instance, a makeshift splint for a broken leg may be made by rolling a blanket tightly from both sides. The leg is placed between these rolls, and the rolls themselves may be stiffened by using sticks, umbrellas, or canes. For padding, grass or leaves may be used. A quickly improvised stretcher can be made by placing two poles through the sleeves of several coats, buttoning the coats to fasten them firmly. Ladders, doors, or old shutters may also be used. Plenty of bandages may be quickly assembled by cutting sheets and clothing into strips.

Homemakers, modern campers, and woodsmen should be prepared for emergencies by having first aid kits on hand. In the home, emergency phone numbers for a doctor, respirator, and the Poison Control Center should be readily available. The first aid kit should contain disinfectants, bandages, compresses, adhesive tape, splints, and simple remedies for aches and pains.



2045 6345



FISH AND FISHERIES. Is an oyster a fish? Is a whale a fish? How can one tell a fish from other animals which live in water? There is a very simple test. A fish has a backbone, but no fingers or toes.

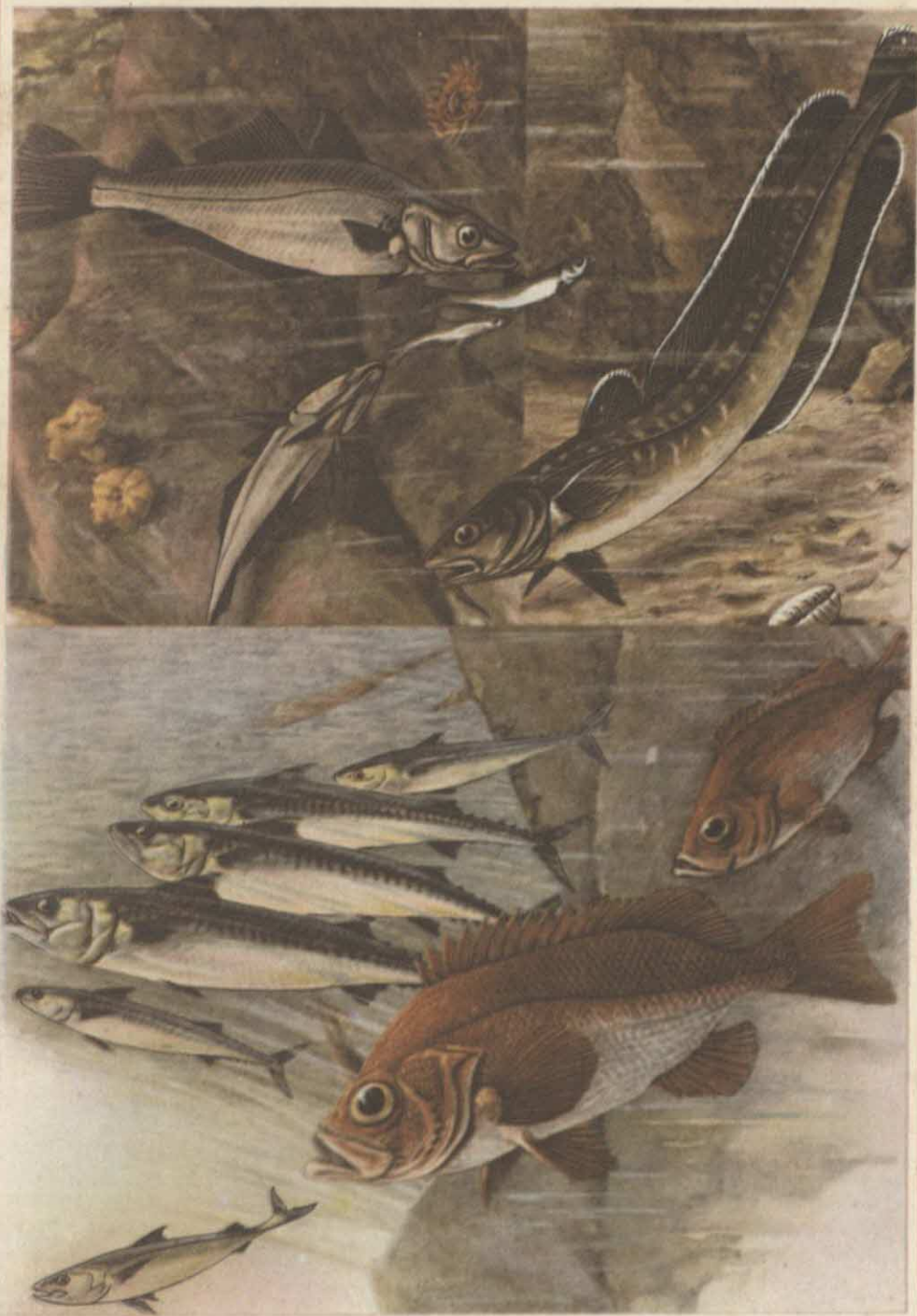
Although we speak of oysters and other bivalve animals as shellfish, they are really not fish, because they do not have backbones. Neither is the whale a fish because, although it has a backbone, it also has the bony skeleton of fingers and toes. The whale is a mammal, belonging to the highest class of vertebrates. Fish make up the lowest class of vertebrates, called *Pisces*, which is divided into more than 30,000 known species.

Ewing Galloway, N.Y.

Where They Live. Most fishes live only in the water, because it is there that their air supply is present in the right quantity. The water passes through their mouths and out over the gills, openings at the back of the head which form the breathing organ. If the water and air are not mixed in the right proportion, the fish will not remain healthy. The proper mixture, however, varies greatly with different fishes.

An air bladder is used by some fishes to assist them in breathing, and in these species it enables the fishes to breathe air directly. Although fishes with air bladders live the greater part of their lives in water, just as other fishes do, they do not die so





THESE SEA DWELLERS ARE IMPORTANT AS FOOD

Among the important kinds of marine food fishes are the silvery whiting (upper left) and the ling, often dried and salted (upper right). Lower left, the perfectly streamlined mackerel; and on the right, red ruff, a gaudy species of the perch family.



Pacific Fisherman

A SEA OF NETS HUNG OUT TO DRY

The kinds of nets have changed little for many years but the modern fishing boat is streamlined and power-driven. The fishing craft dock, and the fishermen dry their nets, near a modern fish cannery.

quickly when taken from the water. Some are known to climb trees or to live in the mud at the bottom of dried-up streams.

Some fishes live in salt water and others in fresh water; some species can exist in either medium. Many of the sea fishes live at great depths where the pressure of the water is very great, and others live at the surface, where the deep-sea fishes could not exist.

Among fresh-water fishes, too, there are differences. Some live in lakes and others in brooks. Even the brook fishes vary greatly, some preferring the swift water of the rapids, and others inhabiting the quiet pools. In all of these places where fish are found there are differences in their color, form, structure, and habits. The fish of temperate or tropical waters are often more brilliantly colored than those that inhabit the colder waters. A good student of fish can tell at a glance whether a fish feels at home in rapid or quiet water, or whether it is a bottom feeder or a surface feeder.

The Sense Organs. Although it is impossible for us to know exactly how a fish feels, we do know that it has certain reac-

tions and feelings. We do know that a fish sees and tastes and feels, because of the presence of eyes and organs of taste and touch. While fishes have ears of a sort, they do not have the outer ears that are found in higher animals, and experiments have shown that their hearing is rather poor. It is probable that their inner ears serve as organs of balance rather than as organs of hearing.

While other animals may be able to hear better, fish are supreme when it comes to tasting. Most animals can taste things only by placing them in their mouths, where the taste buds are located, or by touching them with their tongues, but most fishes have taste organs scattered over the skin of the entire body. Fish also have an excellent sense of smell, which enables them to detect food. The organs of smell are located in the lining of the nostrils.

Many fish have structures arranged in a line along each side of their bodies which help them to feel what is going on about them. These organs are sometimes located on other parts of the body, depending upon the environment in which the fish lives.

For example, blind fishes which live in dark caves have their heads well supplied with organs of touch.

Fishes' eyes are of value to them in seeing both their food and their enemies. If their food is likely to be found above them, the eyes are frequently placed where they can look up. In some fishes the eyes are quite important in aiding them to change the coloring of the body to correspond with the surroundings. Flounders, for example, will change their color pattern to match the bottom over which they are swimming, provided they are not prevented from seeing.

How Fishes Move. By moving their bodies back and forth in a sidewise fashion, most fishes are able to travel through the water, and with their fins they are able to direct their movements. The fanlike *pectoral* fins behind their heads aid them in moving up or down, toward the surface or the bottom. It is these fins, acting as glider wings, that enable the flying fish to sail through the air. The tail fin is a powerful forward-driving oar that is also used to steer the fish. The fins on the back, called the *dorsals*, and the *anal* fin under the tail, are like the keel of a ship, serving to balance the fish in the water. In some cases the back fins, instead of the tail fin, serve to propel the fish forward.

Food Habits. Fishes eat everything found in water, from tiny forms of life to forms which are as large as or larger than themselves, and we can tell the most important things about their food habits by looking at their mouths. Some fishes, such as suckers, strain their food out of the mud at the bottom of a stream. Their mouths are shaped for sucking up the ooze, and at the back of the head is a strainer-like structure which retains the food but allows the water to pass through the gills. These fishes have their teeth in their throats, as their food is not ready for chewing until it reaches the back of the head.

Other kinds, such as pickerel and sharks, that eat large forms of life, have their teeth in the forepart of their jaws so that



Standard Oil Company (N. J.)

A STITCH IN TIME

Weathered but skilled hands carefully mend any breaks in the nets.

they may capture their prey and chew the food before it reaches the throat; the strainer-like structure common to the sucker is missing. The alimentary canal, or the digestive tract, also varies. In mud fishes it is long and in preying fishes it is short.

Reproduction. Although most species lay eggs, some produce living fish. Salmon, shad, and other sea fishes make yearly trips to fresh water to lay their eggs. The famous salmon "run" that occurs on the Columbia River each year comes when the fishes are fighting their way up to their spawning grounds.

Those fishes that live in lakes usually move into shallow waters or inflowing streams to lay their eggs. Typical examples of this class are bass, whitefish, lake trout, brook trout, and pickerel. Although these fishes all seek similar places in which

to spawn, they differ greatly in the manner in which they lay their eggs. The trout, especially the brook variety, construct elaborate nests in which the eggs are laid and then deserted. In contrast, some bass and sunfish will defend their nests with their lives. Catfish and sticklebacks also will fight to protect their nests. It is the female catfish that fights, while in the case of the bass and stickleback it is the male. Unlike the nest-building fish, the pickerel and whitefish scatter their eggs over the bottom and leave them unprotected.

The fish that move upstream to lay their eggs in shallow places meet others going downstream to spawn in deeper waters. Eels swim from the heads of streams to the sea, where they lay their eggs at great depths. These eggs and many of those of deep-sea fishes, unlike the eggs of fresh-water fishes, rise to the surface, where they will hatch out under proper conditions. Finding it difficult to protect their schools of young, these fishes leave them to shift for themselves. Fortunately, in the earlier stages of their lives many of them are nearly transparent so they are not easily seen by their enemies.

Among the fishes that produce living young is the *ovoviviparous perch*, a minnow-like fresh-water fish found in the waters in California.

Fish in the Diet. Fish is a protein food related to the flesh meats and poultry and may be used as a substitute for meat in the daily diet. Its composition is not dissimilar to that of meat, except that the flesh of most fish contains less fat than the meats. The fishes richest in fat are salmon, shad, herring, Spanish mackerel, and butterfish. Nevertheless, and in spite of the fact that, on the whole, fish is cheaper than meat, people in America eat a comparatively small amount of fish in comparison with the amount of meat consumed and compared to the amount of fish consumed in other lands. This difference used to be due to the fact that a large proportion of the population was remote from the seacoast.

Nowadays, however, with modern facili-

ties for shipping fresh fish by refrigerated railroad cars, trucks, and air freight, and the methods of preservation such as freezing, canning, smoking, and drying, there is no reason why fish cannot be served and eaten by all. Each year the pounds of fish used in America and the varieties of ways it is offered to the consumer steadily increase.

Fish, like meat, is best cooked at not too high a temperature. Since it is low in fat, it is quite common to use a little bacon or salt pork with it or a sauce that is rich in fat. Some acid food, such as lemon juice or tomato, also adds to the flavor of fish.

Fish is most frequently cooked by dredging (sprinkling) it with flour or dipping it in a batter and then sautéing it in hot fat until the flesh has lost its clear appearance. Fish may be fried in deep fat, broiled, boiled, or baked. Baked stuffed fish is an attractive and appetizing dish to serve.

Fisheries. Catching fish for commercial purposes has long been an important industry all over the world. In some countries the fisheries are the leading industry. It has been estimated that the value of the world's yearly catch is around two billion dollars. The man who makes his living by catching fish will, unlike the sportsman, cast his hooks or spread his nets in those places, called fisheries, where the fish are so plentiful that everyone may have his share. Thus, the great sea fisheries of North America are the Grand Banks near Newfoundland, the salmon fisheries of the Pacific coast rivers, and several fresh-water fisheries in the Great Lakes. The fishing industry also includes sponges, mussels, shrimps, oysters, lobsters and other products of the ocean and fresh waters that are not zoologically classed as fish.

Hooks and lines and nets are the devices most commonly used by those who are commercial fishermen. They are of various shapes and sizes. Among the many types of nets are the long *seines*, with wooded floats at the top and weights at the bottom. When the fish have been captured, the nets are drawn to shore and emptied.

Purse nets, used to catch schools of fish,



B. F. Goodrich Company

"VACUUM CLEANER" HARVESTS FISH

Silvery sardines swim into the hold of a modern fishing boat with the help of a large suction hose. A special soft rubber lining in the hose guarantees the fish a safe passage without bruises. The nets are unloaded at the rate of a ton a minute, twice as fast as by hauling the heavy nets by hand. The catch also receives less damage than if it were shoveled into the hold.



A DEEP-WATER DELICACY

Caviar consists of the eggs of the sturgeon. Above, source. Left, the packing process.



are similar to seines, but each is provided with a string which pulls the bottom of the net together after the school has been surrounded. The meshes of *gill* nets are made so fine that when the fish thrusts its head through an opening, its gills are caught in the string and it cannot withdraw.

Pound nets are usually set at the surface and go down six feet or so; fish are guided into them with other nets, and cannot easily escape. *Fykes* are long, tubular nets, held open by hoops. The fish are guided into them by other nets, and have great difficulty in finding a way back. Fish are also caught in quantities in large nets drawn through the water by steamers.

There are various ways of preparing fish for market. Fresh fish, usually the most desirable, are kept from spoiling by being

packed in ice in the hold of the fishing boat as soon as they are caught, and in this way they can be kept in perfect condition for long periods. When smoked, dried, or salted, fish are first cleaned and then allowed to dry on frames in the sunlight. Then they are salted or pickled in brine. Canned fresh fish is also marketed in large quantities.

The by-products of fisheries are another important part of the fishing industry. Fertilizer and stock feed are the most important of the by-products. Crushed oyster shells also find a ready market. Whalebone, glue, fish eggs, and cod-liver and halibut oil are all valuable fishery products.

Fish Culture. Countries that have large fisheries carry on a program of fish culture. It includes the collection and fertilization of the eggs of food fishes; the incubation of eggs in hatcheries; the feeding and rearing of young fishes; and the distribution of fishes or fish eggs to waters where fish may live and grow to furnish sport for fishermen or serve as food. The Fisheries Branch of the Canadian government and the Bureau of Fisheries of the United States have also saved millions of fish that have been washed into shallow pools and ponds by flooding rivers. Some of the states and provinces operate their own hatcheries, while others merely cooperate with their national governments.

There are several different forms of culture employed for fresh-water fish. In *pond* culture, fresh-water fish are placed in ponds, where they lay their eggs. As soon as the parents would naturally leave the young, they are removed, and the young fish are allowed to grow until they are old enough to be "planted" elsewhere. Bass are raised in this way because the parents feed on the young.

In the *tray* method of culture, used largely for trout, the eggs are deposited in trays of finely meshed wire which are placed in tanks of running water. When the young hatch out, they are closely watched for the prevention and spread of disease. The *bottle* method is used for

those fish, such as the whitefish, whose eggs must be kept in slow motion. Water is kept running through a bottle so that the eggs are kept moving.

Salt-water culture differs from that of fresh-water fish in that the newly hatched fish must be carried immediately to some natural breeding ground in the ocean. Lobsters are cared for in the same way; oysters are provided with suitable beds, which are regularly planted with seed oysters.

For additional information, see the articles on various fishes throughout these volumes, under their respective common names.



FISHERMAN HAWK

The osprey, which fishes with its talons.

FISH HAWK. Found both in Europe and in America, the fish hawk is a bird of prey that lives on fish, which it captures with its sharp talons. It is a brown, hawk-like bird with a white head and breast. Its large nest is built in high trees and on cliffs along the shores of the sea or on rivers and lakes. The bird is about two feet long and measures about four feet from tip to tip of the wings.

The fish hawk, known also as the *osprey* or *bald buzzard*, is related to other hawks



Florida State News Bureau



Alaska Visitors Association

THE THRILL OF A FIGHT MAKES FISHING AMERICA'S NO. 1 SPORT

Whether it's big game fish off the Florida coast, muskies of the lake region, or battling trout in Alaska's icy streams, fishing brings out more than 30,000,000 sportsmen each year. The annual cost, including travel, equipment, lodging, and licenses, totals about \$2,000,000,000. Two Florida anglers (left) land a giant silver king tarpon in the Shark River, Everglades National Park. (Right) an Alaska fisherman takes his silver salmon and rainbow trout the easy way.

and to the eagles. Often before it can reach its nest, the fish hawk is pursued by the bald eagle and drops its prey, which the eagle catches and eats.

FISHING, or ANGLING. From the days of Izaak Walton, the godfather of all those who look upon angling as the highest form of sport, down to the present time, fishermen have been the most enthusiastic sportsmen. So excited have they become over their sport that their stories of their prowess of rod and reel fill a large part of humorous American literature. Much of the joy of fishing comes from the long hours spent in the open air, and whether it is fishing in a quiet stream, with a bamboo pole and a bent pin for a hook, or fighting the large fish of the deep sea with expensive flies and reels, the sport has appeal.

The most common methods used in fishing are called *still-fishing* and *fly-casting*. Small and comparatively quiet freshwater fish are caught by still-fishing methods. The only equipment needed for this is a long, elastic pole, a line of firmly twisted silk, a float, and a hook, which is usually baited with minnows, angleworms, or small insects. The still fisherman must patiently sit in his boat or on the banks, frequently for hours at a time, waiting for a fish to take the bait.

Fly-casting is considered a more exciting sport by many of the world's fishermen. This method is used in catching the elusive, fighting game fish in swift mountain streams, and in rivers and lakes. In casting, much more expensive and elaborate equipment is required. A flexible steel or



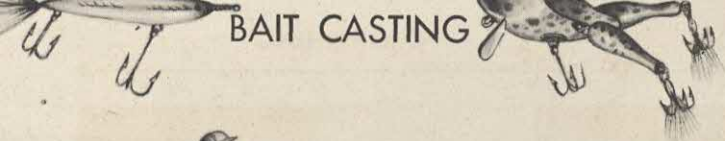
Weyerhaeuser Company

PRESERVATION OF THE SPECIES

Above, small rainbow trout that have been raised in fish hatcheries are "planted" in a lake. There they will grow and reproduce in large enough quantities that they can be caught by fishermen. Below, it is the natural instinct of salmon to leave the salt waters of the ocean to spawn. Each spring they expend great energy leaping rock falls and swimming against the currents of streams to reach their spawning grounds in fresh water.



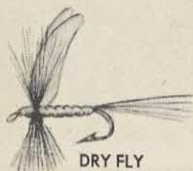
BAIT CASTING



The hand is held so that the reel handles point up. This position permits free wrist action. The thumb is raised from the spool as the rod passes the vertical, and replaced at the end of the cast, when the rod is lowered.



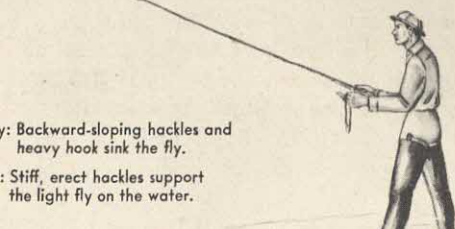
FLY CASTING



DRY FLY

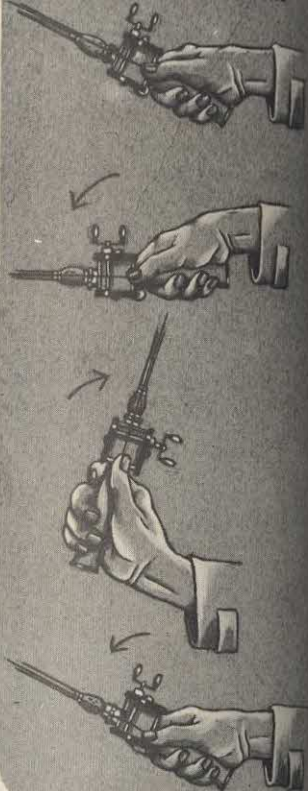


The forearm, not the wrist, moves the rod. The forward cast begins as the line straightens out behind. When it straightens out in front, the coils held in the left hand are released.

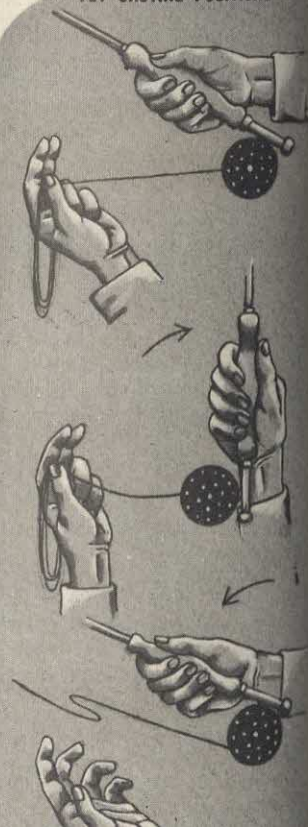


Backward-sloping hackles and heavy hook sink the fly.

Stiff, erect hackles support the light fly on the water.



FLY CASTING POSITIONS





GREAT SPORT FOR YOUNG AND OLD

Fishing is a skill learned early and long remembered. Left, two happy young anglers on the way home from the brook. Right, a fly cast brings a trout to net.

very thin bamboo rod is used, which is made in sections that can be disjointed and stowed away in a small case. A reel, around which is wound a silk line, is attached to the rod.

Although insects and minnows are sometimes used, artificial bait, made of wood and brilliantly colored feathers to which are attached several barbed hooks, is the most common. The line is cast, and the fly is then drawn in or allowed to float downstream. Dry flies float; wet flies sink below the surface. When a fish strikes, the sportsman reels it in and then either beaches it or nets it.

The most expert fishermen have a large variety of bait, each of which is designed to be used under varying conditions. In

the casting, the fish has his chances to win, for the fishermen try to outwit him by finding the places where he is lurking and by choosing the most tempting bait. The successful fisherman studies the habits and food of the fish he wishes to catch, and in this way captures more fish than the person who just takes a chance.

Several other methods have been used to catch the sporting game fish, although most of them have been outlawed. The American Indians caught their fish by spearing them with sharp-pointed poles, and this method is still used in other parts of the world. The use of dynamite to stun fish, so that they can be easily caught as they float on the water, is now unlawful. Some of the natives of South America use



STATEHOOD FOR ALASKA, HAWAII ADDED STARS TO FLAG
The fifty-star United States flag was officially adopted July 4, 1960.

a certain poison that will kill the fish in a particular section of the river, but will still leave them fit to eat.

Many states, along with the Federal government, have passed fishing laws as a part of their conservation program to protect the fish supply. According to these laws, there are only certain seasons of the year in which various species of fish may be caught. The fisherman must also buy a license which allows him to fish for a stated length of time, and limits the size of fish that can be caught. Usually, fishing is allowed only in those seasons when the fish are not spawning. See FISH AND FISHERIES.

FITCH, JOHN (1743-1798). When Robert Fulton's *Clermont* steamed down the broad Hudson River in 1807, it was not the first time that a steam-powered vessel had

chugged and puffed in American waters. In 1790 John Fitch operated a regular passenger service between Philadelphia and Burlington, with a steamboat which he had built and which traveled at a speed of eight miles an hour. Although Fulton is honored as being the inventor of the steamboat, a number of men built workable steamboats earlier, and Fitch, with his commercial service, certainly contributed greatly to the development of steam transportation.

John Fitch was born in East Windsor, Conn. At the beginning of the Revolutionary War he became an officer in the American army. After the war he went on a surveying expedition along the Ohio River. In 1785, after he had moved to Pennsylvania, he constructed a small steamboat. Two years later his second boat made a

successful trip along the Delaware River. He spent the next three years perfecting his invention, and by 1790 had improved it so that it was put into commercial service.

Although his boat proved a success, Fitch was unable to obtain financial support for this venture. He then went to France, where he had heard there was an opportunity to build ships for the French government. However, he was unable to get the appointment and returned to the United States. In 1817, nineteen years after his death, it was decided by a committee of the New York legislature that John Fitch invented the steamboat.

FIVE CIVILIZED TRIBES. Once possessing territory of their own which they governed independently, under the protection of the United States government, the Five Civilized Tribes made up the Seminole nation that formerly lived in the Indian Territory, at present included in the state of Oklahoma. The five tribes that composed this group were the Cherokee, Chickasaw, Choctaw, Creek, and Seminole Indians.

They had lived peacefully for a number of years on their reservations, which were held in joint ownership by the members of each tribe. However, in 1898 Congress passed a law creating a commission to divide the lands of the reservations, giving to each Indian his share. Within a few years, the commission had approved a list of citizens of the Seminole nation. Each Indian was awarded the share of \$308.76 by the government, and the lands were apportioned in plots equal in value to this amount.

Seventy-five thousand Indians had been given 20,000,000 acres of land by 1907. With the discovery of oil in Oklahoma, some of the Indians became immensely wealthy by selling or leasing their lands. Of the nearly 54,000 Indians in Oklahoma today, a large number belong to the Five Civilized Tribes. All are American citizens.

FIVE NATIONS, THE. The fierce, brightly painted Indians that played such an important part in the early history of

the United States were members of the Iroquois tribes that made up a confederacy called the Five Nations. From the time of the landing of the first colonists, the Indians of the Five Nations fiercely resisted the white man who constantly encroached upon their territory along the Saint Lawrence River and in New York and Pennsylvania.

Hoping to gain the support of the Algonquin Indians for the great French fur-trading companies, Champlain helped them in a war against the Iroquois in 1609; and as a result the Iroquois became the lasting enemies of the French. For more than a century and a half, the Iroquois constantly raided the small colonial settlements, burning them and carrying away the inhabitants. In the French and Indian War, the Five Nations fought on the side of England, and also helped the English during the American Revolution.

Hiawatha, made famous by Henry W. Longfellow in his poem of that name, was an important Iroquois chief who organized the tribes so well that the confederation still exists among the present members. Years after the confederacy was set up, the Tuscarora tribe was included, and the English sometimes referred to the confederacy as the Six Nations. Although the Huron Indians were related to the Iroquois tribes, the two were constantly at war. The tribes that made up the original confederacy were the Cayuga, Mohawk, Oneida, Onondaga, and Seneca.

FIXED STARS. In contrast to the wandering planets and their moons and comets, the fixed stars are those which appear not to move. In ancient times men thought that these stars did not move at all. We know now that the stars really do move; but they are so far away and move so slowly, their movements are not visible to the naked eye. See **ASTRONOMY**; **STARS**.

FJORD, fjord. See **FIORD**.

FLAG. For the people of every nation in the world, their flag is a bright and colorful expression of the power, prestige, and ideals of their country. Although it is only

a piece of cloth, a flag stirs the deepest emotions of every patriotic person, for it symbolizes all that has gone into the making of a nation's history.

Flags Through the Ages. The flag itself has had a long history. It may have originated when man first felt the need for some conspicuous emblem to identify his tribe and his possessions; when he longed for something to stand as a symbol of his strength and ideals. When ancient armies were on the march and in battle, flags were used to keep order in the different regiments and to indicate the boundaries of the camps. Flags were adopted by lords and kings, and their armies carried them wherever they went. As certain kings increased their power, their flags became famous and soon took on the significance of national emblems.

The forerunners of the flag were various objects which were held sacred and stood as symbols of their owners' might. These objects were mounted at the ends of spears, called standards, and were carried into battle. Ancient carvings and paintings have been found which show that the regiments of the armies of Egypt had standards. They were usually objects such as sacred animals, tablets, and boats, that were mounted on a staff, and were fearfully and reverently regarded by the soldiers. It was a great honor to carry such a staff. One Assyrian design known to have been used represented a man standing on the back of a bull and aiming a bow and arrow; another emblem showed two bulls running in opposite directions.

The Persians were sun worshipers and sometimes carried a symbol of the sun on the end of a spear; they also used the eagle as an emblem. Both the Egyptians and the Assyrians often attached pennants and streamers to their standards as they went into battle.

The Greeks and Romans used many devices; the early Greeks carried a piece of armor tied to a lance, and the Romans mounted portraits of emperors, figures of Mars or Minerva, or a silver hand on the

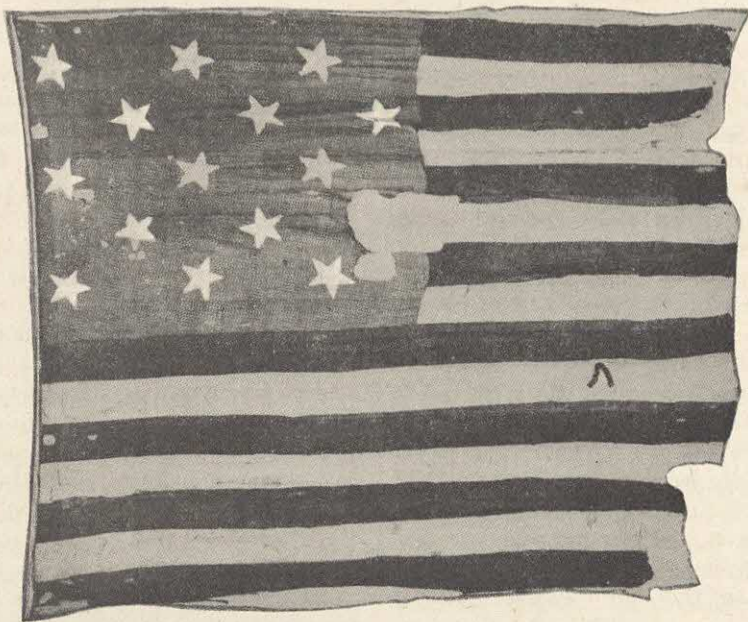
end of a spear. The people of Greek cities were represented by emblems or letters, such as the letter *M* of the Messenians, the olive and the owl of the Athenians, and the sphinx of the Thebans.

The first Roman legions carried figures of a bear, wolf, or horse; later, all legions adopted the eagle as their only standard. The eagle became sacred to the Roman soldier, and he would fight more fiercely to recover it from the enemy than for his life. Roman generals are known to have thrown the eagle standard into the midst of the enemy so as to inspire more savage fighting on the part of their men.

The use of the flag as a symbol grew out of the streamers that were tied to the spear standards. Many of the earliest flags were entirely of religious significance, and many national flags were given added sanctity and prestige by having designs of religious subjects. The oriflamme of France and the Dannebrog of Denmark are examples of such use. It is said that, as King Waldemar of Denmark was directing a battle in 1219, he saw a cross in the sky, and immediately adopted it as the emblem of Denmark. The blue hood of Saint Martin was used by early French kings, and was later replaced by the oriflamme, the emblem of Saint Denis. The cross of Saint George was used in England, the cross of Saint Andrew in Scotland, and the cross of Saint Patrick in Ireland.

Types of Flags. Although in the present day we are more familiar with the flags of nations, many other kinds of flags are used. Flags carried by ships tell to what countries they belong. Government departments and units of the army and navy may have their own emblems; and there are flags that belong to various officers of the government.

The President's flag is blue, with the President's seal in the center and a white star in each corner. The flag of the Secretary of the Navy bears a "fouled" anchor on a field of blue, with a white star in each of the corners. The flag of the Secretary of the Army bears the coat of arms of



WAR-TORN OLD GLORY—"BROAD STRIPES AND BRIGHT STARS"

This tattered relic is the historic "Star-Spangled Banner" that flew above Fort McHenry when the British attacked Baltimore in 1814. It inspired Francis Scott Key to write the national anthem. This flag had fifteen stripes and fifteen stars, one for each state.

the United States on a scarlet field, with a white star in each corner.

The ships of the United States Navy carry rectangular blue flags to show the rank of the commanding officer. The flag of an admiral carries four white stars in the center; that of a vice-admiral, three stars; and of a rear admiral, two stars. These flags are carried at the main, fore, and mizzen masts of a ship, and the narrow pennant of the chief commanding officer flies at the mainmast.

Flags are used for signaling at sea, and ships may exchange messages of all kinds by means of an international code. A flag turned upside down is a sign of distress, and the yellow flag is the quarantine flag. To lower, or strike, a flag in battle is an admission of defeat. Flags are hoisted to only part of the height of the mast as a sign of mourning.

Each nation also has its own private code of signals. Salutes are made by dipping the flag, which is hauling it down a few feet and then running it up again. On

land or sea, the soldiers and sailors of the United States must salute when the flag is raised in the morning and hauled down at sunset.

Showing the White Flag. When an army wishes to stop fighting temporarily in order to communicate with the enemy, a white flag, or flag of truce, is raised. According to the established custom among civilized nations, firing upon a flag of truce is a breach of faith which warrants reprisal. The raising of the flag is in the nature of a message to the commander of the opposing force. He need not accept it, but must warn the messenger not to advance. If the warning is disregarded, the messenger is himself responsible for any injury. The flag of truce is to be used for no other purpose than direct communication. Its misuse is subject to the most drastic penalties.

The Stars and Stripes. Although the United States has had an official flag since the nation was founded, the Stars and Stripes, as we know it today, was changed several times before it was given its present

form. Before the Declaration of Independence was written, some of the colonies had their own flags. One carried the picture of a pine tree and another bore the figure of a coiled snake with the words "Don't tread on me."

The first flag to represent the thirteen colonies bore thirteen red and white stripes and carried the design of the British flag in the upper left-hand corner. It was known as the Cambridge Flag and was hoisted over the first navy on December 3, 1775. On January 2, 1776, George Washington adopted it as the official flag of the Continental Army.

When the Declaration of Independence was issued, it was thought that the new nation needed a distinctive flag of its own. On June 14, 1777, the Congress passed a resolution declaring: "That the flag of the Thirteen United States shall be thirteen stripes, alternate white and red, and that the union be thirteen stars, white on a blue field."

The first flag, said to have been made by Betsy Ross, had thirteen five-pointed stars arranged in a circle. A flag of fifteen stars and fifteen stripes was adopted by Congress and approved by Washington in 1794, after Vermont and Kentucky were admitted to the Union. Although other states were later admitted, this remained the national flag until 1818, when Congress adopted a flag with thirteen stripes and a star for each state. This is the form of the present American flag with its thirteen stripes for the original states.

The Stars and Stripes has always been associated with the Revolutionary War. The first naval victory under the flag was won by the American *Ranger* over the British *Drake* in 1778. Legend says that the first flag flown was hastily made from a sheet, bits of red cloth, and an old blue coat, when the British made a surprise attack on Fort Stanwix, N. Y., on August 3, 1777. Actually, the flag was first used by the colonial fighters at Bennington, Vt., thirteen days later.

Flag Day is observed by Americans on

June 14, for it was on this day, in 1777, that Congress adopted the first United States flag.

The *Pledge of Allegiance* to the American flag is: I pledge allegiance to the Flag of the United States of America and to the Republic for which it stands, one Nation, under God, indivisible, with liberty and justice for all.

Flags of Great Britain. The Union Flag or Union Jack, as the national flag of Great Britain is called, captures British history in its design. On it are united the English cross of St. George, the Scottish cross of St. Andrew, and the Irish cross of St. Patrick. In 1606 James I, King of England and Scotland, ordered that the ships of his subjects fly both St. George's cross and St. Andrew's cross; and a century later, with the union of England and Scotland, Queen Anne approved a flag on which the crosses were united as the official flag of the realm. In 1880, when Ireland became a part of the union, the cross of St. Patrick was added, giving to the flag the form that is in use today wherever Great Britain is represented.

The royal standard of Great Britain is divided into four quarters; the upper left- and the lower right-hand quarters have three gold lions on a red field, standing for England; a single red lion on a gold field (for Scotland) is in the upper right quarter; and a gold harp on a blue field (for Ireland) is in the lower left quarter.

Commonwealth Flags. When Canada, Australia, New Zealand, the Union of South Africa, and Northern Ireland became independent members of the Commonwealth of Nations, each adopted a flag combining its own national symbol and Britain's Union Jack. After becoming a republic in 1950, India continued to be associated with the Commonwealth but had a status different from that of the older members. As a result of this difference, it decided against using any British symbol on its flag. Pakistan and Ceylon soon followed India's example.

United Nations Flag. On October 20,

1947, the United Nations adopted its flag, which was first flown the next day. Light blue in color, the flag has in its center the United Nations symbol—a white polar map of the world embraced by twin olive branches.

FLAG OFFICER. See RANK.

FLAG OF TRUCE. A plain white flag raised on the battlefield means that the side raising it wants a truce, or temporary peace. In many cases it means that a conference is desired with the enemy's leaders for discussing a settlement of differences. If the enemy agrees to the truce, both sides stop fighting. Attacking anyone carrying a flag of truce is considered dishonorable. The symbol of the white flag is used the world over.



THE TROPICS' ROSE-PINK BEAUTY
Flamingos, probably because of their unusual grace and color, have a romantic reputation.

FLAMIN'GO. Now rare north of the Bahamas and Central America, the flamingo is a strange-looking wading bird once found in Southern United States. There are species also in Southern Europe,



BATTLEFIELD OF EUROPE

Flanders has seen many of the world's important conflicts. Here is the Lion of Waterloo.

Africa, India, and South America. A distinctive character is that the plumage of these birds is pink or red, sometimes a brilliant vermillion, which has been a lure to hunters and the cause of the great decrease in numbers.

The flamingo has a gooselike body set on long legs with webbed feet, and a very long, slender neck. The bill is peculiar, very large and heavy and bent abruptly downward at the middle, almost as though broken. In feeding, the bird lowers its bill, top downward, into shallow water or soft mud, and sways its head from side to side, straining out the seeds and small animals it stirs up with its feet. Flamingos nest in colonies on the shores of islands or salt lakes along the seacoast.

The nest is a low mound of mud in the hollowed top of which a white egg or two is laid. The young are soon able to shift for themselves, but are grayish white in color, and, it should be noted, do not attain the typical red plumage for several years.

FLAN'DERS. The lines of the poem by John McCrae

In Flanders fields the poppies grow
Between the Crosses row on row

immediately call World War I to mind. Some of the most important battles of the great struggle took place in the two small Belgian provinces of East and West Flan-



Philip Gendreau



"Cliché C.G.T."—Photograph Dédé



"Cliché C.G.T."—Photograph Dédé

PEACEFUL FLANDERS

Wars that have raced across this ancient corner of Belgium seem far remote in these pictures. The baby, top left, enjoys a ride on a tandem bicycle. Quiet water has reflected the five towers of the romanesque cathedral at Tournai, above, since the 1100's. The market hall at Bruges, at right, with its belfry and 47-bell carillon, dates from the 1200's.

ders. Once Flanders, under powerful rulers, included land now held by both the French and the Dutch, where the native tongue, Flemish, is still spoken. The people of these provinces, industrious and home-loving, are proud of their exceedingly clean homes and fine gardens. The leading occupation is the manufacture of lace and linen from the flax grown in East Flanders.

The important cities in the western province are Bruges, the capital; Ypres, an historic city which met destruction in World War I; and Zeebrugge, famous as a submarine base. The population of about 1,003,000 inhabits 1,248 square miles.

Extensively cultivated, East Flanders has an area of 1,147 square miles. In addition to flax, wheat is an important crop. The population is more than 1,223,000. The quaint old city of Ghent is the capital of the province. See BELGIUM.

FLAT'FISH. Found chiefly in salt water, the queer-looking flatfish is really flat and has both eyes on the same side of its head. It lives on the bottom of the sea. There are several kinds of flatfish, the most important being the *flounder*, *turbot*, *halibut*, and *sole*, all valuable sources of food. The skate and other members of the ray family are also called flatfish.



U.S.D.A.

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FLAX, THE FIBER CROP THAT DATES BACK TO THE STONE AGE

The delicate, five-petaled blossoms of flax, at top, are usually white or blue, but may be red or yellow. Sometimes flax is grown as an ornamental plant. The oval, flattened seeds, above, which follow the flowers are so small that hundreds may be held in one hand. The seeds are crushed to produce linseed oil, used in paints, varnishes, oilcloth, linoleum and medicines, and linseed cake, a livestock food. Below, flax fiber for linen is squared up after scutching. This process removes the short lengths, and aligns the remaining fibers.

Australian News & Information Bureau

FLATHEAD. As a term of derision, this name was applied to the Salishan Indians of Northwestern Montana by various other tribes in the West. It was a practice of the Indian tribes that lived along the Columbia River to press the heads of their babies into a peak, by means of a wicker headboard that was placed on their cradles. As the heads of the Salish children were of normal shape, the Columbia River Indians scorned them by giving them the name of *flathead*. The Salishan Indians were friendly to the white men and could be relied upon.

FLAX. The world's finest tablecloths, most attractive napkins, and many of its choice towels and handkerchiefs all owe their origin to flax, the well-known fiber plant from which linen cloth is manufactured. One of the oldest fiber plants known



to man, flax was cultivated in ancient Egypt and China. One species of it was cultivated in Europe during the Stone Age.

Flax is a slender, rather delicate plant, growing from two to three feet tall. The stems are usually free from branches except near the top. The plant bears slender, narrow leaves from three-fourths to one and a half inches long, and small five-petaled flowers usually of a delicate blue shade, though in some species they are white. The seed bolls are spherical in shape and contain from six to nine mature seeds, flat, brown in color, very smooth, and slippery when moistened.

Leading Producers of Flax. Few agricultural products require more labor than does flax, for, from the time it is planted until the fiber is prepared, every step must be carefully handled. Two general types of flax are raised: fiber flax and seed flax. Seed flax, even though sown thickly and handled like fiber flax, will not produce a good fiber. Likewise, fiber flax will not produce so many seeds as seed flax. The two types are generally grown in different localities. Flax is grown in many countries, including Soviet Russia, the Netherlands, Ireland, Belgium, Egypt, Japan, China, India, Uruguay, Argentina, Peru, Canada, and the United States, particularly in Minnesota, North Dakota, South Dakota, California, and Montana.

Raising the Flax Crop. Flax is generally sown thickly in much the same manner as wheat. If raised only for seed, the crop is cut and threshed (sometimes by a single machine) after it has ripened. Fiber flax, harvested before it is ripe, was once generally pulled by hand, but modern reapers now harvest it satisfactorily. After the flax has dried in the fields, its seeds are removed by hand or by a combing machine known as a rippler.

After the "seeding" process, the plant is thrown into water and allowed to rot, or *ret*, until the bark and fiber separate easily from the woody inner portion of the stalks. Retting requires from ten to twenty days. The fiber is next freed from the bark and

the woody core of the stem, by *breaking* it over a grooved board by means of a wooden handle, or with grooved rollers. The fiber may then be separated by means of a broad, wooden blade called a *scutching* blade, or by a scutching machine, which beats the flax in the direction of its fiber. The fibers are next combed, or *hackled*, several times, each combing producing a finer grade of fiber.

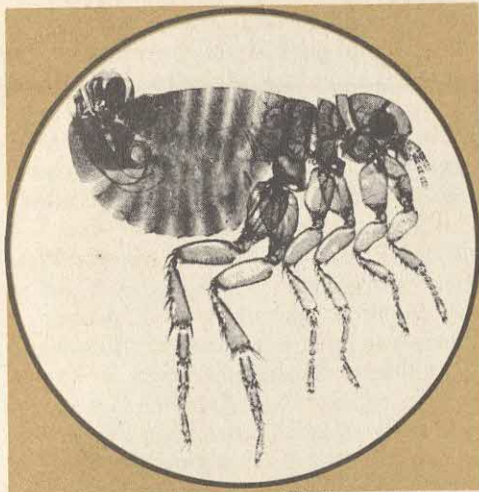
A Plant of Many Uses. The fiber is woven into linen cloth for tablecloths, napkins, towels, and handkerchiefs and even dresses and suits; it is also made into thread and twine, cordage, sailcloth, webbings, and strappings. It has even been used to cover airplane wings.

The seed of the plant is considered almost as valuable as is the fiber. By crushing these seeds, linseed oil is produced, a product that is used in mixing paints and varnishes, for medical purposes, and in the manufacture of oilcloth and linoleum. See *LINSEED*.

FLEA. Rather widely distributed over a large part of the earth, fleas are not only annoying insects but are also dangerous carriers of the germs that cause the dreaded bubonic plague. They get these germs by biting infected rats.

Adult fleas feed entirely upon the blood of mammals and birds, and while the majority of species have their preferred host, several species will attack more than one kind of animal. The common species that attack man are the human fleas, and the cat and dog fleas. They breed in accumulations of organic matter in the cracks of the floors, in corners of closets, under heavy pieces of furniture, in basement rooms, or in the soil under buildings where animals are allowed to sleep.

The eggs are not only laid in these places, but also are laid loosely among the hairs of the host, and drop to the ground or floor, where they hatch. The larvae, which are slender, whitish, and wormlike, feed on the decaying organic matter for a period varying from a few days to several months, depending on the species and the conditions.



FLEA, TINY BUT DANGEROUS

Fleas as household pests are usually introduced on cats and dogs, although along the Pacific coast and in the South, the human flea is not uncommon.

FLEUR-DE-LIS, *flur de le'*. When the French knights of the twelfth century rode eastward on the Second Crusade, they bore on their shields and helmets the device of the fleur-de-lis, a conventionalized design of the lily, or white iris. The fleur-de-lis was first adopted as an emblem by Louis VII of France in 1147. It has long been used in heraldry and has served as a symbolic decoration. Today the pins awarded to Boy Scouts are in the shape of the fleur-de-lis.

The plant itself has large, sword-shaped leaves and bears blossoms with six petals; three petals stand upright and three droop. The flowers grow abundantly both in gardens and in woods and have beautiful color combinations of lavender, white, and yellow.



FLYING ANT-EATER

A handsome olive-brown bird flecked with black and white, the flicker feeds on ants.

FLICK'ER. Big, handsome flickers are well known to bird lovers of the United States, east of the Rockies. Their popularity is shown by the variety of local names given them in different parts of the country—*clape*, *high-hole*, *golden-winged woodpecker*, *yellow hammer*, *yucker*, *pigeon woodpecker*, and scores more.

The flicker is a little over a foot in length. Its general color is brown with black bars above, and pale lilac-drab with black spots below. On the back of the neck it has a red bar, on the breast a black crescent, on the rump a white patch showing plainly in flight; and the undersides of the wings and tail are yellow. Besides being the only



FLINT WAS THE PRIMITIVE'S IRON

From it, early man made arrowheads (left), spear heads (right), and knives and hatchets (below). Top left, shaping a piece of flint; top right and center, flint hammers.

brownish woodpecker in the Eastern states, it differs from other woodpeckers in spending much of its time on the ground in search of ants, for which it has a great liking. Indeed, its habits are all good and it is worthy of every encouragement.

FLINT. Used for weapons and tools by primitive men of all ages, flint is a variety of quartz which sparks when struck by steel. It was formerly also used for gun flints and as a means of striking fire in contact with steel before the days of matches. Its chief uses now are for grinding pebbles which are used in great rotating cylinders to pulverize ores, portland cement, and other hard substances that are desired in

powdered form; and as a source of pure silica used in the body of pottery as well as in the glaze. Practically all the flint used now in the United States is brought from Europe, where it is picked up in the form of pebbles, on the seacoast.

Flint rates 7 in the scale of hardness. See **CHALCEDONY**; **QUARTZ**.

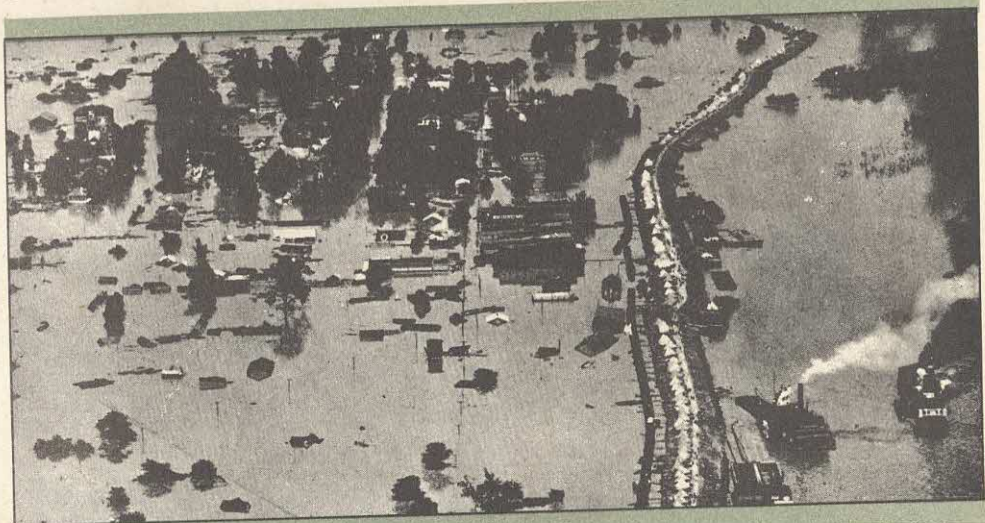
FLINT, MICH. Situated on the Flint River about sixty-eight miles northwest of Detroit, Flint is a thriving business center. With a population of about 197,000, it is the second largest city in Michigan and the county seat of Genesee County. Its prosperity is based on a huge automobile industry. With the exception of Detroit, it produces more automobiles than any other city in the United States. Buick and Chevrolet automobiles are manufactured here, as are the Fisher bodies used on these cars. The Flint factories produce almost every kind of part and accessory used in the manufacture of automobiles, such as speedometers, spark plugs, and instrument panels. An institute of technology and an automobile proving ground are maintained by the General Motors Corporation.

One of the largest duco-paint factories in the United States is located at Flint; and there are other factories that produce tents and awnings, brass and aluminum castings, sheet metal, and fabricated steel. The city has a good transportation system, three airports, and a stadium seating 20,000 people.

FLOOD. Whenever land not usually covered by water becomes inundated, a flood is said to occur.

The most common kinds of floods are those which rise along the courses of rivers. Sudden melting of snow and ice over a large part of a river's watershed, and unusually heavy rainfall in this drainage area, are frequent causes of floods. These conditions come most often in the springtime, when the atmospheric temperature rises and the ground is still deeply frozen.

Another type of flood is caused by the temporary blocking of a river by an avalanche or landslide. The choking of the



Courtesy U. S. Army Air Corps

THE FATHER OF WATERS SPREADS DESOLATION AND RUIN

The Mississippi-Missouri, world's longest river, drains so large an area that in rainy years the mighty waters overflow their banks for miles around; wreak terrible damage.

river channel causes a temporary lake and a flood above the obstruction; and the giving way of this barrier often causes ruinous floods downstream. Similar floods are caused by the formation of ice dams which occur in narrow places in the river channel at the time of the spring break-up. Ice dams are common on rivers which freeze to a considerable depth in winter. In some rivers the luxuriant growth of vegetation may choke the channel and cause a rise of water. This very often happens along the course of the Upper Nile.

The sudden changing of the course of a river is often attended by disastrous floods. In China the Hwang Ho has changed its lower course nine times in the last 2,000 years, causing the destruction of many millions of lives. Similar floods are apt to take place along the lower courses of rivers that pass through flood plains. The breaking of the levees along the Mississippi, especially during the flood season, is often accompanied by dire results. In the rainy season, the Nile, overflowing its banks, leaves enough moisture and valuable silt deposits on the flood plains to make continued agriculture possible.

The breaking of artificial dams has sometimes caused disastrous floods, as at Johnstown, Penna., in 1889. Tropical hurricanes and earthquakes have also been the cause of floods; the great waves of water often set in motion by these phenomena have wiped out whole cities on the seacoast.

Flood prevention is effected by means of flood-water reservoirs, normally kept empty; by keeping river courses well dredged and free of obstruction; and by assuring adequate strength to dams and levees. One of the greatest wastes of agricultural resources is due to soil erosion, which may be halted to a large extent by damming streams, reforestation cut-over headwater lands, planting and terracing slopes, and checking the growth of gullies.

Predictable, normal floods may have beneficent effects, as in case of the Nile floods in silting and fertilizing the fields of Egypt, but abnormally high floods do inestimable harm, not only to the inundated land, but to human health and prosperity. Typical was the flood of January, 1937, in the valleys of the Allegheny, Ohio, and Mississippi rivers and their tributaries; more than 900 persons lost their lives, some

60,000 families lost their homes, property damage totaled millions of dollars, and transport, communication, and sanitation services were disrupted. Existing levees were hastily built higher, but no human engineering could match the power of the mass of accumulated water.

Horried by this, the nation's worst flood, Congress appropriated the first funds for a national flood-control program in 1938. Since then, many more river basins have been brought under control. Enormous sums have been spent on building reservoirs, levees, and other control works, on reforestation, and on educating landowners to carry out flood-prevention measures. See CONSERVATION; DAMS; FORESTS AND FORESTRY; LEVEE; RECLAMATION.

FLOOD PLAIN. Along the lower courses of most streams, sometimes stretching for miles on both sides, are low, flat tracts of land. These have been made by the rivers in overflowing their banks and depositing a part of their sediments. After heavy rains or spring thawing, streams, with their volume of water greatly increased, can carry much more than an average amount of sediment. If the water of a stream becomes so high as to flow over its banks and spread out, the current at once becomes slower, and the sediment which it can no longer carry is dropped along the sides. Deposits made in this way form *flood plains*.

Some rivers overflow their banks with great regularity and build flood plains rapidly, as do the Mississippi and the Nile. Their yearly deposit of new fine soil is an excellent fertilizer, and, like the soil of deltas, is very productive. Occasionally the river overflows after the crops are in, and in this case may do much damage, both by flooding and by burying the crops under silt. The flood plain of the Nile and that of the Tigris and Euphrates rivers were seats of the very earliest civilizations known, and their fertility of soil was largely responsible for man's making such rapid advancement there. The Nile Valley was the cradle of civilization.

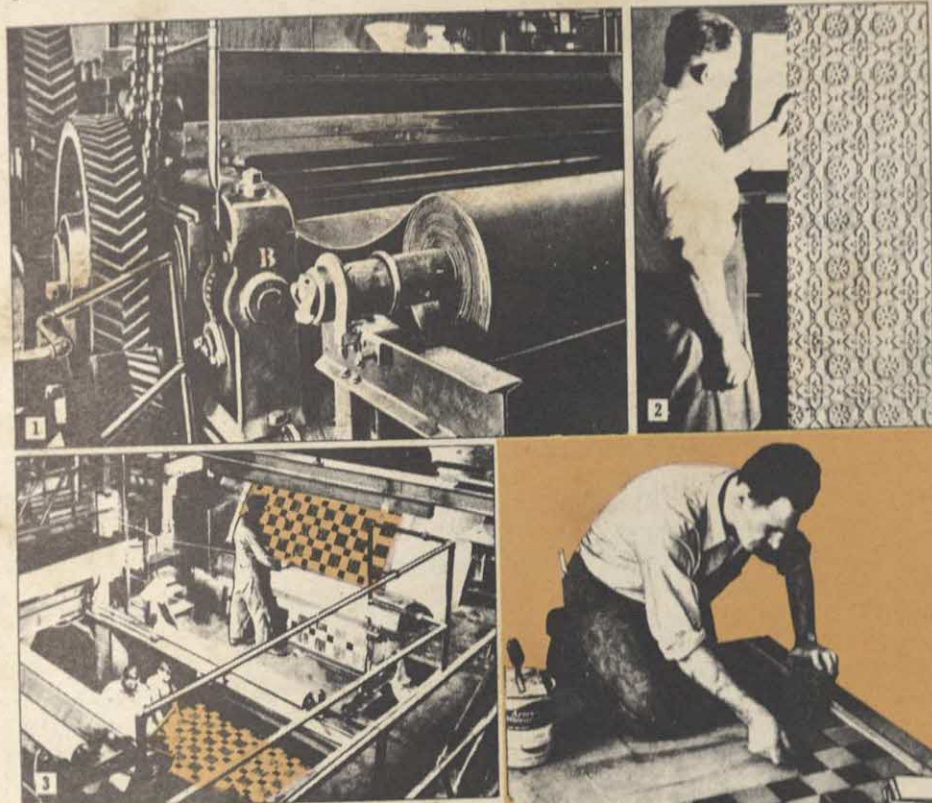
FLOOR COVERING. Thin layers of leaves, straw, sand, or animal skins served as the earliest floor coverings in the homes of man. Carpets as floor coverings were used first in Egypt, for religious purposes by the priests and also to ornament the palaces of the Pharaohs. They were often spread under the couches of guests at banquets.

The Babylonians were very skillful in weaving, and ornamented their carpets with groups of human figures, with dragons, the sphinx, and the griffin. Many of these carpets were exported to Greece and Rome, where they were highly prized. The skill of the ancient Babylonian carpet weavers has been handed down from generation to generation, and at the present time the carpets of Persia are still prized and sought after by Western nations.

Oriental carpets were introduced into Spain by the Moors, and the Crusaders brought Turkish carpets with them when they returned from the Holy Land. Later, carpets were imported into Italy, and from there Western Europe was supplied. Frequent mention is made of carpets during the Middle Ages, when they were used in the chambers of royalty, before the altars in chapels and cathedrals, and in the bowers of *ladies faire*. The troubadours had carpets of gold which they laid on the grass.

Carpets, however, were used only by the wealthy class, for, among the common people of Europe at this period, a thin spread of straw, herbs, or sweet-smelling rushes furnished the floor covering, as it still does in many places. Only within the past century have carpets and rugs been manufactured cheaply enough to make their use general.

In the United States, before the Revolutionary period, the only carpet much used was the homemade rag carpet which is still popular as a floor covering. In some of the more elaborately furnished homes, carpets from Europe were occasionally found. In 1791 the first carpet factory in the United States was erected by William P. Sprague of Philadelphia. The first carpet made in



(1-4) Courtesy Armstrong Cork Co.

BEAUTY AND COMFORT UNDER FOOT

Floor coverings of today range from gorgeous Oriental rugs to modernistic linoleums. These modern floorings are made of cork and hemp combined under pressure by rolls (1). (2) A pattern for printed linoleum. (3) A linoleum printer. (4) Laying linoleum tile. (5) A rare Persian rug.

the factory was one designed for the United States Senate chamber.

In 1845, Erastus Bigelow, a young American, succeeded in weaving on a power loom of his own invention, a carpet that was of good quality, with patterns that would match perfectly. This invention made it possible to produce carpets at so low a cost as to be within the reach of many people.

Of all materials now used for floor coverings, straw matting is one of the most ancient, its manufacture in China dating from prehistoric times.

Linoleum is a comparatively new type of



Courtesy Nabighian Bros.

floor covering, the first patent for its manufacture having been obtained in 1860.

Carpets and rugs are made from the same materials. Carpet comes in strips which can be cut and sewed to cover all

the floor space of a room. A rug is either woven in one piece or is made of strips of carpet sewed together and often finished with a border, and is usually smaller than the floor area. In most cases, carpets are fastened to the floor; rugs ordinarily are not. (In England the distinction between rug and carpet is merely one of size.)

Many Kinds of Carpets. Carpets manufactured at the present time may be placed into two general classes: (1) *flat carpet*, a double-faced fabric which can be used on either side; and (2) *pile carpet*, a fabric having a nap of either loops or tufts on the right side, with a foundation or back of some cheaper material such as jute or hemp. The better carpets are made of wool, but cotton, hair, paper, and other materials are sometimes used to cheapen the product. There are several standard kinds of carpet made, varying in methods of weaving and dyeing.

Ingrain carpet is made of wool or cotton dyed in the yarn; each skein of yarn is dyed before being woven. *Body Brussels* carpet belongs to the pile class, its face being composed of small loops of yarn, its back of hemp or jute. *Tapestry Brussels* resembles body Brussels, but the surface yarns are not woven through the backing, and there is no color shown on the back. *Wilton* carpet is a pile carpet, with the pile composed of short ends rather than loops.

Velvet carpet is a pile carpet, woven like tapestry Brussels, but with the loops cut. It is a cheaper grade and does not wear well. *Axminster* is a pile carpet with face composed of long cut ends, and can be distinguished from Wilton or velvet by its deep pile. *Chenille* carpet is a pile carpet made up of weft strands of a special yarn, and is usually the most expensive of domestic or European carpetings.

The Parents of Today's Floor Coverings. Handmade Oriental rugs are the oldest of all modern carpeting. They have a pile surface made up of short lengths of yarn knotted around the regular warp threads, and are built up tuft by tuft according to the design in the mind of the weaver.

Oriental rugs are used less extensively than domestic rugs because of their cost. Oriental rugs may be divided into four general classes, *Persian*, *Turkoman*, *Caucasian*, and *Turkish*, and each class is again subdivided according to the different districts in which rugs are made.

The weaving of these rugs has been done by these people for generations, and the methods used today are the same as centuries ago. The colors in these rugs, made from vegetable dyes, are beautiful and furnish one of their outstanding charms. The *prayer rug* is a rug designed by the Oriental for use when kneeling to say his prayers. If one buys an Oriental rug, it is a wise plan to purchase from a reliable dealer who is an expert in judging the quality, since it requires a great deal of study to be a judge of these rugs.

Other Floor Coverings. Other types of floor coverings include Navajo rugs or blankets, rag rugs, grass rugs, coco matting, and straw matting from China or Japan.

Linoleum is used extensively on kitchen, hallway, bathroom, and nursery floors, and on the floors of many rooms in schools, hospitals, and public buildings. It is composed of oxidized linseed oil and ground cork mixed to a plastic mass and pressed into a prepared back. Because it is resilient underfoot, long-wearing, easy to keep clean, and produced in many pleasing patterns and colors, linoleum has won enduring popularity.

FLORENCE, *flaw'rens*, ITALY. In the fertile valley of the winding Arno in Central Italy lies Florence, the city of beautiful art treasures and famous men. The Italians know it as *Firenze la Bella*, "Florence the Beautiful." No spot in the modern world can lay claim to so illustrious a past, a heritage which boasts of such men as Dante, Michelangelo, Cellini, Leonardo da Vinci, Petrarch, Boccaccio, Donatello, Ghiberti, Galileo, Cimabue, Americus Vesputius, Andrea del Sarto, Machiavelli, and Savonarola.

Admitted as a Roman colony in 59 B. C., Florence became the jewelry center of the



Renaissance Art Flowered in Florence



Above, Cathedral of Florence, Santa Maria del Fiore. The Cathedral was the work of many architects between 1296 to 1462. Brunelleschi designed the masterful dome; Giotto and Pisano, the campanile (bell tower) to the right.

Left, Third Bronze Doors on Baptistery (octagonal structure in picture at top of page). Designed by Lorenzo Ghiberti (fifteenth century), they were called the "Gates of Paradise" by Michelangelo.

Right, "Perseus with Head of Medusa." Bronze sculpture of Benvenuto Cellini (sixteenth century). Cellini was a dynamic sculptor who worked for Francis I of France, among others, and wrote an autobiography.

ENLIT—Chicago



world with the products of its gold- and silver-smiths, highly prized for both table and decorative use. For almost three centuries (1282-1530) it was a city republic, but in its latter years, from 1434, it fell under the control of the powerful Medici family. Thanks to Lorenzo de' Medici, called "the Magnificent," whose interests were not in power but in culture, Florence became the heart of the Italian Renaissance. It fell as a republic before the army of Charles V, and was eventually merged with the Grand Duchy of Tuscany, where it remained until the kingdom of Italy was established in the last century. For the first six years of the kingdom, it served as the capital, but relinquished the honor to Rome in 1871. At present it is the capital of the province of Florence, now called Firenze.

Florentine Art. In the Pitti Palace and the Uffizi are some of the world's finest works of the old masters who made up the Florentine School — particularly those of Leonardo da Vinci and Michelangelo. Connecting these two buildings is a passageway over the Ponte Vecchio, or Old Bridge, which crosses the Arno. The dome of Saint Peter's in Rome was inspired by the Cathedral of Saint Mary of the Flower, which stands in a square surrounded by other structures of interest. There can be found Giotto's bell tower, or campanile, and the Baptistery with the famous bronze doors fashioned by Ghiberti.

The churches of Florence are numerous, and provide points of interest at every turn. In the Church of San Lorenzo may be found the tombs of the Medici and the statues executed by Michelangelo. Decorating the walls of the monastery of San Marco, which sheltered Savonarola, are Fra Angelico's lovely angel faces. The tombs of many of Florence's great are in the noted Church of Santa Croce, among them being Galileo, Michelangelo, and Machiavelli.

FLORICULTURE. Many of the world's most beautiful flowers have been developed by a science known as floriculture. Botany deals with the structure, classification, and function of the parts of a plant; but flori-

culture is especially concerned with the cultivation, development, and value of the various flowers for decorative purposes.

Modern Floriculture. The man who operates your local greenhouse must be an expert floriculturist, for flowers form the principal source of his income. He must know what flowers appeal to the greatest number of people, how they are raised, and how prepared for market. He will cultivate, as a rule, only such flowers as will keep for a long time, whether potted or cut.

Cut flowers must have long stems, pleasing color and appearance, and be able to withstand packing and shipping. The most popular cut flowers are roses, carnations, violets, narcissus, orchids, chrysanthemums, and snapdragons.

Potted flowers are sold in large quantities to flower lovers for home culture. Such flowers are usually of a dwarf variety, able to withstand house conditions and not too difficult to grow. The most popular potted flowers and plants are ferns, palms, primroses, begonias, poinsettias, cyclamen, gloxinias, and geraniums.

Floriculture at Home. No one is too rich or too poor to enjoy the raising of flowers. Real enjoyment and recreation can be had by watching over flowers, cultivating them, and designing a flower garden. In time, if he reads and studies about his hobby, the flower enthusiast will learn much about the nature of the soil and the part birds and bees play in flower growth.

Conservatories and Nurseries. The most interesting spots in many of our large city parks are the conservatories, where fascinating tropical plants, too delicate for outdoor growth, are raised. Here are grown such unusual specimens as banana trees, pitcher plants, rare orchids, coffee trees, and dozens of other tropical plants.

Still another important cog in the wheel of floriculture is the nurseryman, who supplies us with trees, shrubs, and flowers for outdoor growth. He is often able to give sound advice on planning a flower garden, and is also frequently an expert in the art of landscape gardening. See GREENHOUSE.

FLORIDA, LAND OF SUNSHINE

Picnickers pedal through the gates of St. Augustine, oldest city in the United States. The gates are made of a cemented mixture of shell and coral called coquina. They were part of the city's fortifications, built about 1708. The city itself was founded in 1565 by Pedro Menéndez de Avilés, commander of the Indies fleet, who firmly established Spanish control in Florida. The stone ornaments atop the gateposts represent pomegranates, Spanish symbols of fertility.



J. Carver Harris

FLORIDA. Oranges and grapefruit, Palm Beach and Miami Beach—these mean Florida to most of us. Famous for its production of fruit and its pleasant climate that makes it one of the outstanding winter resorts in North America, Florida, "the Peninsula State," lies at the extreme southeastern corner of the United States. Its 1,888-mile coast line, longer than that of any other state of the Union except Alaska, extends along the Atlantic Ocean on the east and the Gulf of Mexico on the west. Georgia and Alabama lie to the north; the Straits of Florida to the south. The Florida Keys, small, low, coral islands, extend for 200 miles to the southwest. The total area of the state is 58,666 square miles, of which 3,805 square miles are inland water.

There is probably no more popular playground in the United States, and every year thousands of tourists invade the cities and seaside resorts of Florida. Few places in the United States have a greater variety of plant and animal life. With a tropical and subtropical climate, the state abounds with colorful birds and exotic

fruits and plants.

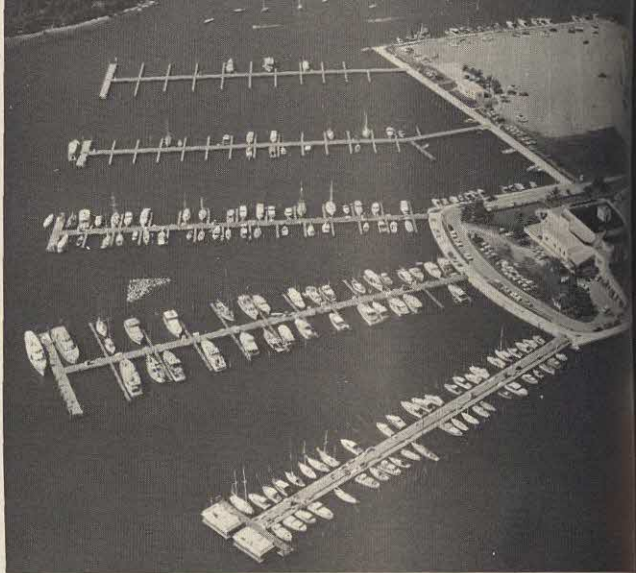
The Land and Its Waters. The highlands of Alabama extend into the northwestern corner of Florida and gradually level out to the flat coast along the Gulf of Mexico. The highest point in the state, Iron Mountain (325 feet), is in Central Florida in Polk County. On the summit of the mountain is the celebrated Singing Tower, erected through the generosity of Edward Bok. This bell tower and the near-by bird sanctuary attract thousands of visitors yearly. See **SINGING TOWER**.

The Florida east coast is low and regular, but gently slopes upward toward the interior. The west coast, with its deep indentations, has many good harbors for commercial and pleasure boats. These coastal lands, often marshy, have been formed by a gradual rising of the land and by the action of small organisms that secrete lime. This process still continues along the coast and in the Florida Keys.

Much of the land of Florida is wet and marshy, but in recent years many of the swamps have been drained and turned into productive farms. The most famous



Florida State News Bureau



City of Miami

FISHING AND BOATING AT THEIR BEST

Left, there's plenty of help and advice when an angler hooks a tarpon off the Florida coast. Right, one of Florida's largest dock facilities is this five-fingered marina near downtown Miami. It can berth 370 boats and offers water, electricity, and other services.

swamps are the Big Cypress and the Everglades, which cover a large section of Southern Florida. See **EVERGLADES**.

The state has several large rivers, but they are navigable only for small boats. Lake Okeechobee drains into the Gulf of Mexico through the Caloosahatchee River. The boundary between Florida and Georgia is partly formed by the Saint Mary's River. Other important rivers are the Saint John's, the Peace, and the famous Suwanee, which flows south into the Gulf through the north-central part of the state, and the Apalachicola, which is formed by the Chattahoochee and Flint rivers in Alabama and Georgia. Okeechobee, with an area of 1,250 square miles, is the largest of Florida's 35,000 lakes.

Temperature and Rainfall. Florida is noted for its lack of extreme temperatures. Very seldom does the thermometer register lower than 32° or higher than 90° F. That Florida is truly a playground at all times of the year is shown by the fact that the average annual temperature is 60° in winter and 81° in summer, a range of only 21°. Florida's rainy season comes in June, July, and August, and is so short that summer

weather can be said to prevail for two thirds of the year. However, rain falls at all times of the year, and is much heavier than that in more temperate regions. It averages between fifty and sixty inches for the state, with some coastal regions along the Gulf of Mexico receiving more.

Products of Forest and Farm. Agriculture is the most important industry in Florida. Fruits are, of course, the outstanding products. They are grown chiefly in the middle and southern portions of the state. The leading fruits are oranges, bananas, pineapples, olives, coconuts, and avocados. The orange crop is the most important and is often more valuable than all other crops combined. Grapefruit are also raised in large quantities and, along with oranges and pineapples, make up a great part of Florida's exports.

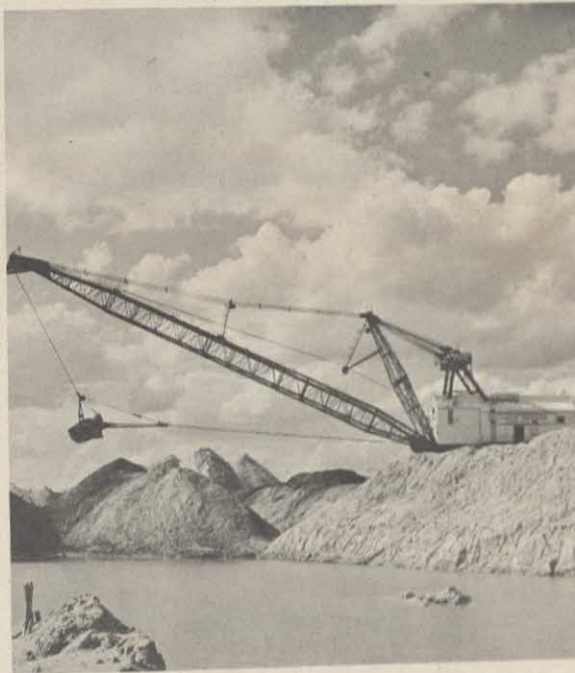
Middle Florida, in addition to raising many kinds of fruits, also has large crops of cotton, sugar cane, tobacco, and potatoes. The products of the northern parts of the state are more closely related to those of temperate regions. With the exception of wheat, the northern section harvests large crops of cereals, and also rice, potatoes, to-



Photos from Florida State News Bureau

FLORIDANS WORK WHILE NORTHERNERS PLAY

Florida produces many things besides sunshine for tourists. Cattle ranches, such as the one above, now compete with the west in beef production. Sturdy Brahman bulls have greatly increased the quality of Florida herds. "Bigger Digger," mammoth shovel at right, is used to extract natural phosphate rock from Florida's marine beds. Phosphate is used in the manufacture of fertilizer. There are plenty of shrimp cocktails in this haul, lower left. Great shrimp fleets range as far south as northern Mexico. Truck gardens mean fresh salads for Northerners in winter. Workers, lower right, harvest cucumbers that will be shipped to every part of the country in fast refrigerator cars.





Florida East Coast Ry.; Robert E. Fisher

THE OLD WORLD AND THE NEW

influence of old Spain is still strong in Florida, as is shown by this Augustine hotel courtyard at right. But modern progress is the keynote in such cities as Jacksonville (above).



bacon, cotton, watermelons, and berries. Pecans, peanuts, and tung nuts (used in making paints and varnishes) also are important crops. Throughout the state, the raising of vegetables is an extremely valuable source of income, especially in the south, where vast quantities of winter ones are produced for northern markets. Some vegetables and flowers are grown hydroponically (without soil) in Florida. Beef cattle are extensively raised, the chief type being the humped, droopy-eared Brahman. Dairying, beekeeping, and the raising of poultry, hogs, sheep, horses, and mules also are important.

Florida's extensive forests yield large supplies of pine, cypress, gum, oak, and many other kinds of lumber. From its great stands of long leaf and slash pine trees come other important forest products, including turpentine, resin, pine oil, wood pulp, and wood for making boxes.

Fisheries. The waters along Florida's coastline abound with fighting, deep-sea fish, such as the barracuda, tarpon, and sailfish. They attract many fishermen and make deep-sea fishing a leading tourist sport. Commercial fishing is also an important industry, its products including oysters, shad, red snapper, pompano, mul-

let, bream, mackerel, shrimp, clams, sea turtles, stone crabs, and lobsterlike crawfish. The only sponges taken off the coasts of the continental United States come from Florida, almost entirely from Tarpon Springs. Alligators and crocodiles are hunted for their skins in the swamps, the home also of tropical birds and snakes.

Minerals and Industry. Florida is one of the world's largest suppliers of phosphate rock. Other minerals produced include fuller's earth, flint, cement and building stones, kaolin, ilmenite, rutile, zircon, sand, gravel, oil, and uranium.

Caring for tourists and operating greenhouses and nurseries are leading Florida industries, as are agriculture, fishing, and lumbering. Also important is the processing of foods and tobacco. Ybor City and Tampa are cigar-making centers. Other manufactures include chemicals, truck trailers, clothing, hardware, paper containers, furniture, and novelties.

People and Institutions. Florida has a population of about 4,942,000. Miami, a great resort center, is the largest city, and Tallahassee is the capital. Other major cities include Tampa, Jacksonville, St. Petersburg, Orlando, and Miami Beach.

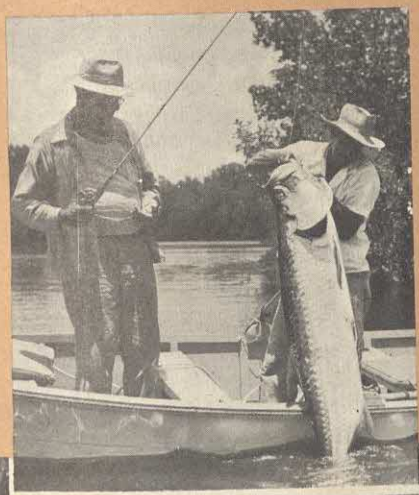
The University of Florida, at Gainesville,



Section of Fine Arts, P.B.A.; Florida News & Photo Service; Florida State News Bureau

FLORIDA'S FRONTIER

In Florida's Everglades, historic home of the courageous Seminoles (above), the state's glittering resorts and bustling industries seem far away. Here one finds giant alligators, graceful deer, and such game fish as the fighting tarpon.

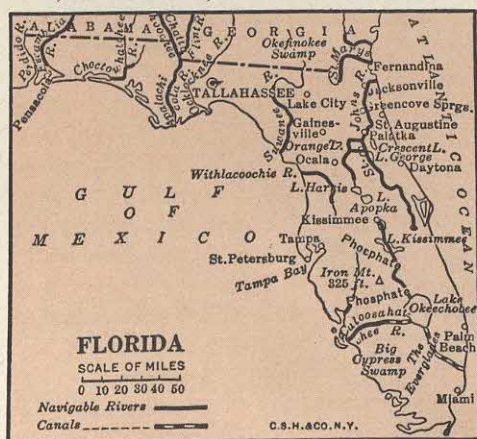


is at the head of the state educational system. Other leading institutions of higher learning for white students are Rollins College, the John B. Stetson University, and the University of Miami. There are also two colleges for the education of Negroes.

Florida elects a governor for a four-year term. A two-house legislature is composed of the senate, whose members are elected for four years, and an assembly, chosen for two years.

History. Ponce de Leon, a Spanish explorer, discovered Florida in 1513 when he was searching for the fountain of eternal youth. De Soto, in his explorations in the southern part of the United States, traveled through the state. Later, parties of Huguenots, driven from their homes in France, attempted to set up colonies in Florida, but were massacred by Spaniards under Menendez, who founded Saint Augustine, the oldest city in the United States.

The territory came under the control of the English by the terms of the treaty of 1763, and was ceded to Spain in 1783. The United States gained possession of it in 1819. Florida long served as a place of refuge for thieves, pirates, and escaped slaves. The United States government sent several expeditions, one under the leadership of Andrew Jackson, to drive out the pirates. After a responsible territorial government was established, Florida was admitted to the Union as the twenty-seventh state, on March 3, 1845.



OCEANIC STREAMLINER

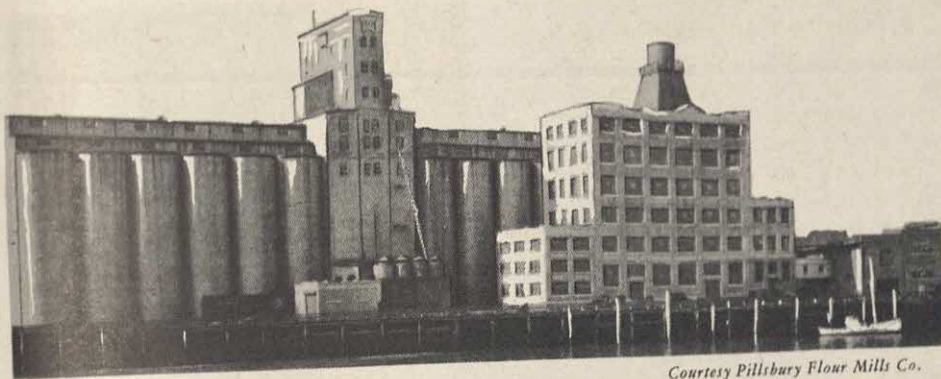
The flounder, a curious flatfish highly prized as a food, has both eyes on one side.

FLOUN'DER. Persons fishing along the Atlantic and Gulf coasts of North America have little trouble in catching flounders. These are curious, flat fish with both eyes on one side.

The young flounder has an eye on either side as an ordinary fish does, but as it develops, gradually one eye moves to the other side, and the fish turns over so that the eyes are on the top. Flounders lie flat on the sand under water, and, with similar fishes, are sometimes called *flatfish*. The upper side is colored like the sea bottom, the underside is white. Flounders are valuable as food.

Flounders swim upstream for considerable distances, but are most commonly found in salt water. Some species grow to weigh several hundred pounds. However, one of the most important flounders is the *winter flounder*, found from Labrador to the Carolinas. This fish is very common, but rarely gets to be large enough to weigh more than five pounds. What it loses in size it makes up for in abundance.

Winter flounders breed in early spring, and as this time comes between the breeding time of cod and that of lobsters, flounders are hatched in hatcheries when the hatcheries would otherwise be idle. Another important flounder is the *pole flounder*, or "pole fluke," of the deep waters of the North Atlantic. Halibut and flounders belong to the same family (see HALIBUT)



Courtesy Pillsbury Flour Mills Co.

FOR THE NATION'S BREAD BASKET

Flour, the basic ingredient of bread, is one of the most important of all foods. Great banks of elevators, where grain is stored before being made into flour, are a common sight in the North-Central cities where the nation's flour milling is done.

FLOUR. For thousands of years, man has ground and sifted the best portion of grains to make flour for bread. In the beginning, it appears, the grains were broken by pounding. Later came the use of a hollowed stone into which fitted another stone. The grinding was done with a rolling motion. Early in, or shortly before, the Christian Era the Romans developed a device known as a *quern*, made up of two stones, the upper one being turned round and round. Grain was dropped into a hole in the upper stone and flour came out at the edges.

The quern was quite commonly used in Britain up to the seventeenth century. Gradually the stones were flattened out, then later grooved, and grooved stones were the means of grinding until about 1870, when the rolls came into use. Roller mills were not employed in any large number until about 1880. In the early days, just as now, a system of grinding and sifting, and grinding again was used to give the various types and grades of flours.

There are flours on the market made from all the common grains such as wheat, rye, barley, corn, oats, and rice. Many of them, other than wheat, play an important part in breadmaking. The wheat flours, however, have qualities which make them superior to all others for yeast bread, and

are used wherever it is possible to obtain them. Some of the others are used for quick breads for variety; and the meals and rolled grains, such as corn meal and oat meal, are valued by every housekeeper for their use in muffins, cookies, mush, and porridge.

When flour is ground, there are three distinct products secured, the *bran*, the *middlings*, and the *flour*. The middlings are ground to the desired fineness to form ordinary white flour. Unground, they are often sold as breakfast food. The stock feed called "middlings" is largely composed of ground bran and dust. *Whole-wheat* flour or graham flour consists of ground wheat kernels, including bran and wheat germ. Further refining results in a loss of protein.

Patent flour is, in the United States, the best quality white wheat flour, with all of the bran and most of the germ removed. It is high in food value and is approximately seventy-seven per cent carbohydrate, or starch, eleven per cent protein, one per cent fat, ten per cent water, and the rest ash.

The chief protein is *gluten*, composed of *gliadin* and *glutenin*. These two proteins unite to form gluten when flour is mixed with water. Gliadin gives the gluten tenacity and elasticity, and glutenin gives it strength. See BREAD.



CULTIVATED LOVELINESS

Carnations (above) are the second most popular florists' flower, and delphiniums (right) are at home in every well-groomed garden.



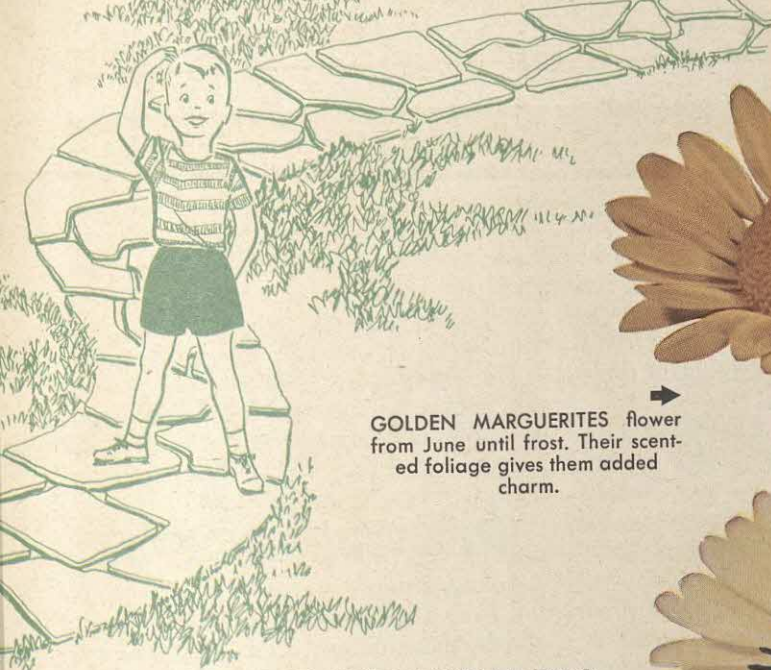
FLOWERS. Be they rich or poor in terms of money, people who love flowers will always be wealthy, for beautiful blossoms are within reach of all. Flowers, so perfect in form and color, bring joy and comfort to the world, whether they lift their proud heads in formal gardens and bouquets, or carpet the green floor of a woodland glade. They provide a simple yet inspiring hobby for a multitude of gardeners; they are the basis of a great industry of which just the retail branch, in the United States alone, achieves annual sales of nearly 100 million dollars.

The lovely blossom of an aster, a delphinium, a pansy, or a rose suggests that the flower is the culmination of the life of the plant—the rich reward of its work and growth. It is, however, but a means to an end. Exquisitely fashioned and delicately tinted though the flower may be, it has work to do, either active or passive. For the sole purpose of the natural plant unwarped and unmodified by the gardener is to produce seed, and the flower is the part of the plant to which that important function has been specially entrusted.

What Flowers Are. A flower is nothing more nor less than a modified branch—modified so that it may produce seed—and its parts, so varied in form, texture, and color, are but modified leaves. Flower buds appear just where branch shoots appear, and nowhere else. That is, a bud may arise from the tip of a stem, and be a *terminal* bud, or it may arise from the axil of a leaf, and be an *axillary* bud; but it cannot, unless it be a mere *adventitious* bud, appear at any other point on the plant. (An adventitious bud is one occurring in some other than the natural place, as on an exposed root, or where the plant surface has been injured.)

There are just two absolutely essential parts to a flower, and those two are rarely seen, or at least rarely observed: they are the *pollen* and the *ovule*. A typical blossom, that of the cherry, will serve to illustrate the more conspicuous parts of a flower.

First, and most evident, are the two floral



→
GOLDEN MARGUERITES flower
 from June until frost. Their scented
 foliage gives them added
 charm.

Prepared with the co-operation of the Wayside Gardens and the A. B. Morse Co.



HARDY ASTERS prolong the garden season. They
 bear their starry flowers in autumn.



envelopes. The outer one, composed of tiny green leaves, is the *calyx*, and each little leaf is a *sepal*. In the opened blossom the calyx has apparently no special function; it has done its work by protecting the delicate inner parts when the flower was a bud. Every complete, typical flower has a calyx, but it is never safe to assume that this organ must always be a circle of inconspicuous little leaves. In some flowers it is the showiest part.

Set within the circle of the calyx is another circle, composed of delicate white leaves, or *petals*. This is the *corolla*, usually the most conspicuous and attractive part of the flower. The corolla, too, has its part to play in protecting the "inner circles," but chiefly it is designed to attract visitors; not human visitors—they do the blossom no service; but insect visitors, which burrow into the blossom for nectar, all unconsciously take up pollen on head or body, and carry it to the next blossom visited.

Within the corolla is a row of somewhat feathery organs—the *stamens*. These are the pollen-bearing organs, the pollen being contained in the little knob, or *anther*, at the top of the stamen.

At the very center of the blossom are the pistils, at the bottom of which, in a walled chamber called the *ovary*, are stored the ovules, from which are to come fruit, seeds, and future generations of plants.

It is easy to believe that the sepals of the outer floral envelope are altered leaves, for they are very little altered; it is not difficult to believe that the petals, also, are such leaves, for, changed as they are in color and texture, they are yet distinctly leaflike in appearance. But the botanist tells us that the stamens and pistils, too, are modified leaves, and that is by no means so evident.

An examination of a very well-known and common flower will illustrate this fact in a fascinating manner. A white water lily, when furred as a bud, is wrapped in green sepals. When the blossom opens, however, these sepals are seen to be white on the inside—that is, they look much like the petals. Next come several rows of white

petals, growing narrower toward the center; and the innermost ones are tipped with yellow, like a stamen. Gradually the petal narrows into a *filament*, the yellow tip develops into a true anther—and the petals have changed to stamens. In other blossoms the pistils and stamens occasionally change into each other; and there is no real hard and fast distinction between the parts.

Flowers of the Garden. All flowers which bloom under cultivation fall naturally into three groups, according to the length of time they live. These groups are *annuals*, *biennials*, and *perennials*.

Annual flowers are the ones which need to be started from seed each year. Strictly speaking, annuals are plants which, starting from seed, will bloom, produce seed, and die the same year. Of course, there are a great many annuals that drop their seeds into the soil in the summer, where they remain until spring before they germinate; then they start, but the parent plant dies. Such annuals are said to self-sow; they send up "volunteer plants," as gardeners say.

Annuals have many uses. For rented houses, about which one wishes an immediate flower effect, such annuals as zinnias, marigolds, calliopsis, and verbenas are very useful. There are usually spots in the perennial or shrub border where some plant fails to live up to expectation, and in such spaces annuals are necessary. For window and porch boxes and for lawn vases, annuals are most acceptable. The existence of an annual depends upon its ability to produce an abundance of seed. Annuals, therefore, are prolific bloomers. Some of them have long stems and keep well, so that they serve excellently as cut flowers. China asters, cosmos, and sweet peas are examples of this class.

Many annuals may be sown directly where they are to grow and bloom. For these, the soil should be carefully prepared and enriched with fertilizer and bone meal. Certain other annuals it is best to sow indoors, in pots or shallow boxes, in order to give them a warmer start and make them bloom earlier. Or they may be started early



W. Atlee Burpee Co.; Bermuda News Bureau
SOME FAMILIAR FRIENDS

Each gardener has his favorite plants, but the flowers shown on this page are enjoyed by almost everyone. Above are pansies; at top right, columbine; at right, a zinnia; at bottom right, sweet peas; and below, nasturtiums. All but the columbine are annuals. Zinnias, sweet peas, and nasturtiums flourish in sunlight; pansies and columbine, in semishade.





CAMPIONS add a bright touch to rock gardens. Some kinds have a clovelike fragrance.



TRANSVAAL DAISIES like the sunniest spots. They flower all summer long.

AZALEAS ARE MASSES OF BLOSSOMS in spring and early summer. Hardy sorts can survive northern winters.





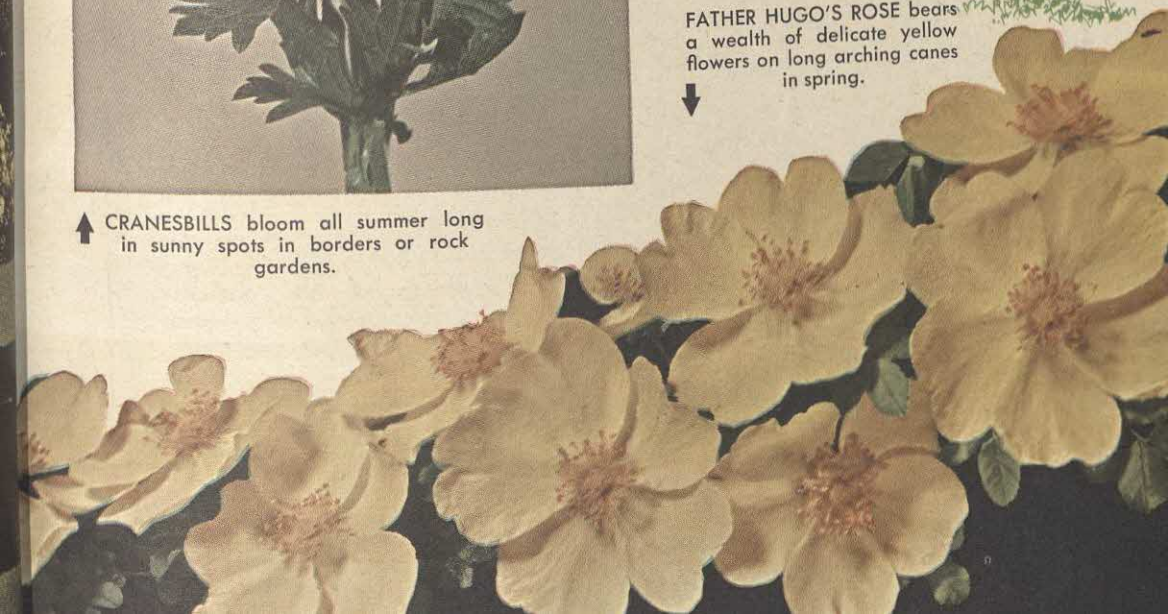
HYPERICUM is a low shrub that bears fragrant golden flowers from early summer until mid-fall.



FATHER HUGO'S ROSE bears a wealth of delicate yellow flowers on long arching canes in spring.



↑ CRANESBILLS bloom all summer long in sunny spots in borders or rock gardens.



GARDENER'S GUIDE—A Chart of Annuals for Your Garden

Name	Color	Height in Inches	Additional Information
Ageratum	White, purple ..	3 to 18	Excellent annual for edging
Alyssum	White, yellow ..	4 to 15	Standard white edging plant
Amarantus	Crimson, yellow	24 to 30	Needs plenty of space
Bachelor's Button	White, red, blue.	18 to 36	Keep seed heads picked
Balsam (Lady's-slipper)	Various	12 to 14	Needs a sunny location
Browallia	Blue	12 to 15	Dainty; good for cutting
Butterfly Flower	Various	12 to 36	Most dainty. Partial shade
Calendula	Lemon, orange..	12 to 24	Keep flowers picked
California Poppy.....	Orange, white, pink	10 to 15	Makes gorgeous masses of border
Calliopsis	Yellow, orange, red	12 to 36	Good cut flower
Candytuft	White, crimson..	6 to 10	Sow several times for succession of bloom
Castor Oil Plant.....	Green and bronze leaves	72 to 84	Good for rapid-growing screen
Celosia	Yellow and red	10 to 18	The "cockscomb" has many admirers
China Aster	Various	10 to 24	Start indoors; likes partial shade
Clarkia	White, pink, lilac	12 to 24	Attractive for garden border
Cosmos	White, pink, crimson	48 to 72	Best tall late annual
Everlasting Flowers	Red, yellow	36	Large flowering everlasting
Gaillardia	Yellow, orange, red	12 to 18	Good cut flowers
Globe, Amaranth	Purple, red	12	Cloverlike everlasting flowers
Godetia	Red and white ..	12 to 18	Blooms have satiny luster
Gypsophila	White	12 to 15	Good for bouquets. Very fine flowers
Larkspur, Annual	Blue, pink, white, purple	15	Good cut flower. Sow in sun
Love-in-a-mist	Blue	12 to 18	Dainty. Good for cut flowers
Lupine	White, red, blue	15 to 48	Cut flowers. Dainty, pealike
Mallow, Annual	Pink, white	24	Sow where they are to grow
Marigold, African	Yellow, orange ..	18 to 36	Scented leaves. Always successful
Marigold, French	Orange, maroon ..	12	Good edging plant
Mignonette	White, yellow, red	12 to 24	Fragrance delicious. Sandy soil
Nasturtium, Dwarf	Various	12	Incomparable cut flower
Nicotiana	White, pink	36	Fragrant in evening
Petunia	Various	6 to 36	One of the most flowery annuals
Pink, China (see DIANTHUS)	Various	12 to 15	Old favorites
Phlox, Annual	Various	18 to 24	Best started in boxes
Poppy	Various	18 to 24	Always attractive. Sow seed thinly and do not try to transplant
Portulaca	Various	2 to 12	Good in dry soil
Salpiglossis	Various	24 to 30	Deserves wider culture
Scabiosa (see MOURNING BRIDE)	Various	18 to 30	Long stems; cut flowers; attractive
Scarlet Sage (see SALVIA)	Scarlet	15 to 24	Start indoors. Stands partial shade
Snapdragon	Various	4 to 36	Excellent for garden cut flowers
Stock	Various	12 to 30	Fragrant. Start indoors
Summer Cypress	Foliage turns red	24 to 30	Color is poor in late summer
Sunflower	Yellow	60 to 72	An old standard
Swan River Daisy	Blue, pink	8 to 10	A dainty edging daisy
Verbena	Various	6 to 18	Start indoors
Zinnia	Various	10 to 36	Always a success



outdoors in cold frames, glass-topped board shelters which are heated by the sun and keep off cool winds. Half-hardy annuals planted this way include China asters, Drummond's phlox, verbena, ageratum, sweet alyssum, and petunias. When the seedlings get a few true leaves, they are transplanted to the ground where they are to grow.

Biennial flowers are those that live two years. Seed is sown one year and the following season the plants bloom and then die. For practical purposes, biennials are treated like annuals; seed is planted each year to provide flowers for the next season. Foxglove, sweet William, and some varieties of hollyhock are biennials.

Perennial flowers include all that naturally live more than two growing seasons. All trees, shrubs, and bulbous plants are classed as *woody* perennials, while plants with no wood in their structure are *herbaceous* perennials, such as peonies, iris, lilies, and phlox.



SEASONAL WOODLAND BEAUTIES

Dainty asters grow wild and carry summer's living beauty far into the fall. Charming blossoms that greet recurrent springtime: (2) the wood violet and (3) the waxy-petaled painted trillium.

Flowers of Field and Forest. What more cherished memories can one have than those of springtime rambles along some woodland road or stream—spying out and treasuring in recollection each shy wild flower in the path? The delicate blossoms of hepaticas, violets, arbutus, trillium, and lady's-slipper stud the turf like so many precious gems.

In summer, fields glow with marigolds, daisies, purple clover heads, and other sturdy blooms; and in the fall, goldenrod and asters mark the season's gentle close. Wild flowers indeed contribute immeasurably to the charm of the countryside, and the movement to conserve them in their natural habitats should receive hearty co-operation from all.

Owing to the destruction wrought by thoughtless people who, not content to pluck the blooms, pull up root and all, many of America's daintiest wild flowers, such as lilies, gentians, wild orchids, and others, are threatened with extinction.

The Individuality of Flowers. All cultivated flowers have been derived from the wild flowers, and their great variety in color, size, and shape has been developed



FORSYTHIAS, or GOLDEN BELLS, bear cascades of tiny flowers before their leaves appear in spring. They decorate shady places as well as sunny spots.



← PEONIES are among the showiest of flowering shrubs. Their rose-scented blossoms appear in late spring.



→ GAY POPPY ANEMONES brighten the shady areas of gardens. They do not like full sunlight.





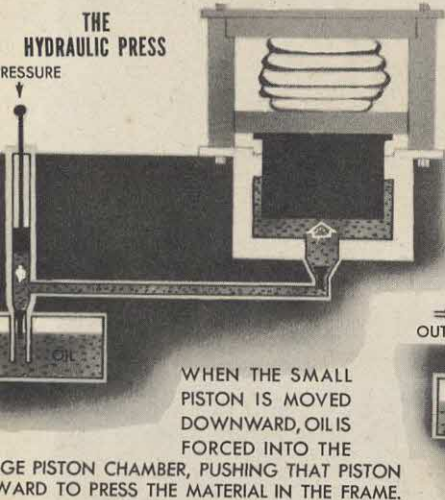
RICH REWARDS AND BRIGHT PROMISE FOR THE FUTURE

Glowing in many a garden plot and border, the bright blossoms of beautiful flowers bring joy to the hearts of men, express Nature's eternal law of growth. The verberna (upper left) and delicate pinks (upper right) are old-fashioned favorites, as are the spiky delphinium (lower left) and the perennial geum (lower right).

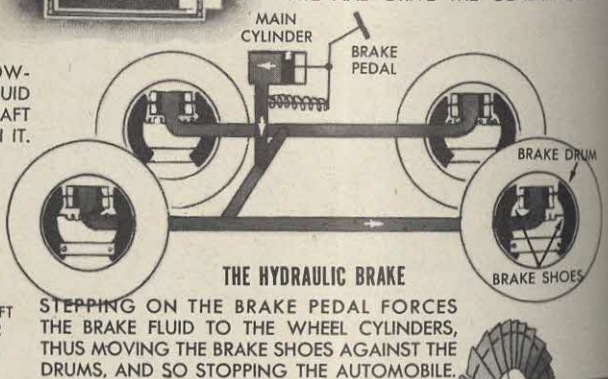
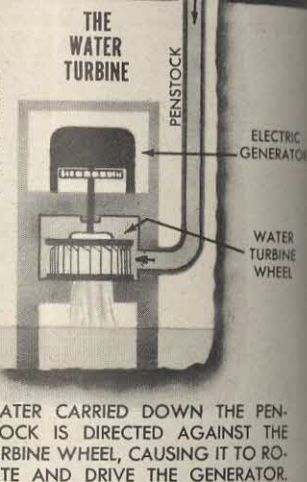
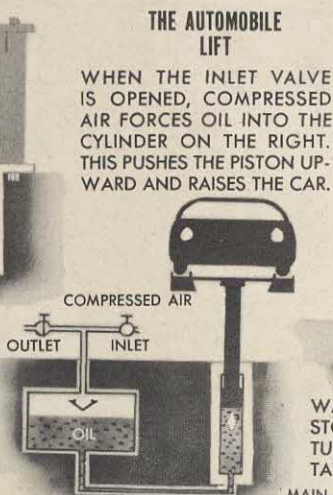
POWER BY FLUIDS

WHETHER LIQUID OR GAS, FLUIDS PROVIDE TREMENDOUS POWER FOR THE EFFICIENT OPERATION OF MANY MACHINES.

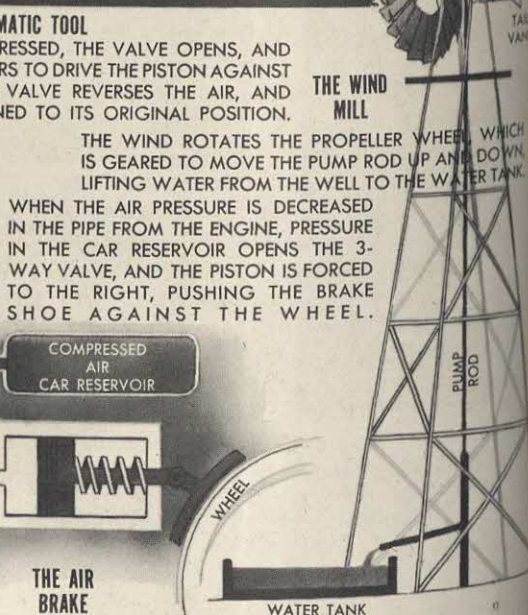
LIQUIDS furnish power to lift weights, rotate wheels, drive automobiles.

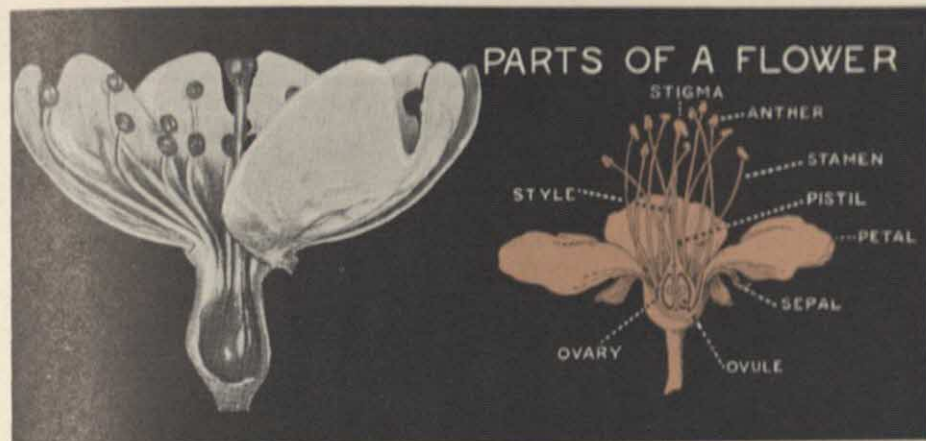


THE CONNECTED FAN DRIVES THE OTHER FAN BY BLOWING A CURRENT OF AIR AGAINST ITS BLADES. IN FLUID DRIVE, THE CRANKSHAFT WHEEL TURNS THE DRIVE-SHAFT WHEEL BY FORCING A CURRENT OF OIL THROUGH IT.



GASES provide power to pump water, stop vehicles, spray paint.





WHAT MAKES A FLOWER BEAUTIFUL?

Blossoms are very alive; here are the principal parts of their marvelous structure.

gradually by scientific breeders in the field of floriculture. It is interesting to note that there are no naturally green flowers, although the plants are green because they contain the chlorophyll which helps them manufacture starch. Ferments in flower seeds are believed to determine the colors of the blossom, which distinguish it from the stem and leaves so that it will lure insects in search of pollen and nectar.

Some of the loveliest flowers grow on trees, particularly fruit trees. The flowers of many trees, however, have no petals and are therefore rarely prominent. Trees are the largest of the flowering plants; some of them are closely related to the fairest flowers of the garden, as, for instance, the apple tree, which is of the same family as the rose.

There is often much variation among members of the same family of flowers. The perfumed lily of the valley is related to the onion and the tulip. The nightshade family includes poisonous weeds as well as the potato and tomato.

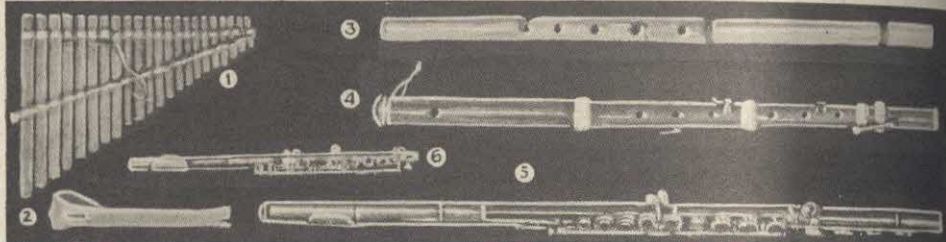
Certain flowering plants have the power to move their leaves and other parts: morning-glories close when the sun grows bright, barberry flowers raise their stamens at a touch, and "the sunflower turns on her god, as he sets, the same smile that she gave when he rose."

See **BOTANY; FERTILIZATION OF PLANTS; POLLEN; SEEDS**; and articles on the separate flowers which appear throughout these volumes.

FLUID. Substances which have weight but no definite shape are called fluids. They are divided into two classes, gases and liquids, which differ from each other in that a liquid has a certain volume, while a gas does not.

To illustrate, take a quantity of water and pour it into a jar. What happens? The water takes on the shape of the jar, whatever it may be. Now pour the water from the jar into a flat dish. The same amount of water is still there, only in a different shape, that of the dish. Put a cover on the dish and try to press down on the water, making it occupy less room. It cannot be made to fill a smaller space, for water will compress less than .00005 of its volume. We now can see the characteristics of a liquid. It will take on the shape of a container; it will pour; it has weight; it cannot be compressed.

The same experiment can be tried with gas. A gas placed in a bottle will take on the shape of the bottle and completely fill it. Now try to pour it into a dish. The substance does not seem to "pour." Instead, it spreads out into the air as well as into the



FROM PIPES OF PAN TO SYMPHONY ORCHESTRA

C. G. Conn Ltd.

The flute, first of the wood winds, is one of the oldest of musical instruments. (1) Egyptian "pipes of Pan" played 5,000 years ago. (2) Ancient bone flute. (3) Chinese cane flute. (4) Orchestral flute of about 1800. (5) Modern Boehm flute. (6) Modern piccolo.

dish. It can expand until traces of the gas can be found in all parts of the room. It may be said that the gas fills the room and takes on that shape. A gas then, we see, has weight; assumes the shape of the container; has no particular volume, for it expands; and, if we had tried to compress it, we would have found that it can be considerably compressed.

For a clearer understanding, solids and fluids should be compared. Solids have their own shape, which ordinarily does not vary with the container. They have weight, but do not pour. Of their own accord, solids do not expand or compress easily.

FLUORINE, *flu' or in*. Most active of the non-metallic chemical elements, fluorine is a light-yellow, poisonous gas which combines with nearly all the other elements, sometimes very violently. It is one of the halogen (salt-producing) group. The gas does not occur free in nature but is found in the compounds fluor spar, cryolite, and apatite. Free fluorine can be produced by electrolysis and can be held in copper containers.

Fluorine compounds are used as refrigerants, antiseptics, stain-removers, insecticides, and preservatives. They are also useful in medicine, and large-scale experiments have been carried out to test the effectiveness of fluorine in drinking water as a means of reducing tooth decay.

Condensed to a liquid, fluorine has a boiling point of -187°C . and a melting point of -233°C . The symbol of fluorine is *F*. See **CHEMISTRY**.

FLUOR SPAR, *floo'or spahr*. This rather uncommon mineral occurs usually in colorless to bluish crystal cubes. It is also called *fluorite* and is a compound of calcium and fluorine. Practically all the fluor spar that is utilized in America is mined in the Illinois-Kentucky district, with lesser amounts coming from New Mexico and Colorado. In Canada, Newfoundland is a leading source of supply. Soviet Russia and Germany are among the European nations rich in fluor spar.

The most important use of fluor spar is as a flux in making open-hearth steel. It is also used to make hydrofluoric acid, which has a variety of industrial uses. Since ancient times fluor spar has been carved as a gem stone.

FLUTE. Easily identified as the only instrument in the orchestra which the player blows across instead of directly into, the flute is a versatile wood wind.

The *embouchure*, or mouthpiece, is set in the side of the instrument and near one end. The flute is a cylindrical tube in three sections, made of wood or metal, with small openings at intervals in the sides. These openings are covered by the player's fingers or by keys. Uncovering one of the openings shortens the column of air and raises the pitch. The flute, as we know it, has a range of three full octaves from middle D, and is the invention of Theobald Boehm, a Bavarian.

The flute is often called the "coloratura soprano" of the orchestra. Its low tones are woody, dark, and menacing; its middle



SWARMING MENACE TO HEALTH

The common house fly, here greatly enlarged, is one of the most dangerous insects known, because he lives on filth and carries germs. (1) The male. (2) The fly's tongue. Notice the suspended dirt. (3) A foot. Here most of the germs are carried.

tones clear and mellow; its high tones brilliant and piercing. It is used as a solo instrument in delicate, lyrical passages; in flute duets, as an accompaniment to the violin melody or to the voice; as the soprano, in a quartet of the wood winds.

FLY. True flies, such as the house fly, mosquito, gnat, and horsefly, are known to scientists as *Diptera*, meaning *two wings*. They have this wing character in common and it distinguishes them from the four-winged insects which have *fly* as part of their names. Flies' wings are attached to the middle section of the thorax, and behind them are the rudiments, or remains, of a second pair of wings, represented by a pair of knobbed threads called *halteres*.

It is only within the last few decades that windows and doors have been universally screened and more efficient fly exterminators

developed in a concerted effort to keep flies from spreading disease. True, they were always considered a nuisance but were tolerated until "Swat the Fly" campaigns emphasized the fact that flies carry disease germs. Now, the breeding places of flies are the first point of attack. Refuse is generally kept covered, oil is poured on stagnant water in swamps, and other sanitary measures are supervised by public authorities to rid the community of insects which are both a bother and a menace to health.

The larvae of Hessian flies, sugarbeet midges, onion flies, cabbage-maggot flies; pomace flies, apple maggots, grass-stem flies, and many others injure and destroy plant life. Horseflies, stable flies, horn flies, botflies, and warble flies are injurious to animal life; still other kinds spoil food and

spread sickness. A few flies are helpful to man because they prey on other insect pests. The helpful kinds include Tachina flies, which feed on army worms and caterpillars; bee flies, which eat grasshopper eggs; and robber flies, which prey on various insects.

In the life of the fly there are the four stages familiar everywhere in the insect world—eggs, larvae (maggots), pupae, and mature flies. See INSECTS.

FLY'CATCHER. As its name implies, this bird feeds almost entirely on insects, particularly flies. During the summer, in the United States and Canada, flycatchers may be seen perched on some lookout spot, alert and ready to dart at any unfortunate

prey that passes. With lightning-like speed the bird seizes the insect with a snap of its bill and returns in an unconcerned manner to await more visitors. However, the flycatcher has no cheerful song to help brighten his day, although many species have musical calls.

Over forty species may be found in the United States and Canada, including the *phoebe*, sometimes a winter resident, the *crested flycatcher*, the *kingbird*, and the *wood pewee*. As the tropics are approached, the birds of this family are marked by more brilliant plumage. With this group one should not include the Old World flycatchers, which belong to another family and differ in many respects.

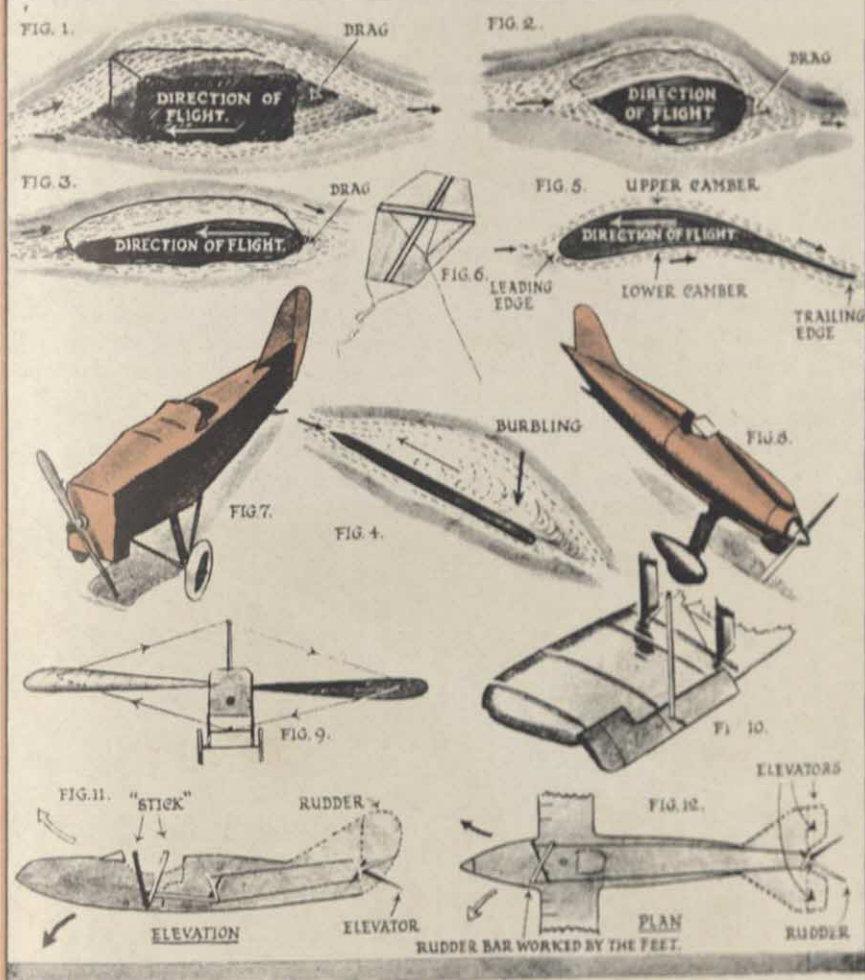


Man's Mastery of the SKYWAYS

FLYING, STORY OF. To soar through the air like the eagle, to lift himself from the ground and fly to strange and wonderful places, like the wild ducks and geese, has always been in the mind of man. Fables and legends tell us of the fanciful wings of Daedalus and Icarus of ancient Crete, who made wings of feathers and wax; the wonderful magic carpet of Baghdad; and the gods of Greece who flew to Mount Olympus. Yet, though man has dreamed of flying from ancient times, it has been only within

the last two centuries that he has been able to do so.

Already, man is looking beyond the sky that so long defied him. Beyond the air he breathes are other wonders that challenge his ability to imitate the birds. The stratosphere, that layer of the atmosphere that lies above the troposphere, the layer in which man lives, is being penetrated for the first time. The moon, the planets, and infinite space are the objects of his imagination now, just as travel a few hundred feet



MAKING THE BEST USE OF THE AIR STREAM

The kite (fig. 6) is kept aloft by the same force—the pressure of the air on its inclined surfaces—which sustains an airplane, although applied in a somewhat different manner. A kite uses existing wind; an airplane must create wind of its own motion. In order for it to fly with the least possible power, all its exposed parts must be so shaped as to slip easily through the air. Square or rough spars (figs. 1, 2, and 3) set up "drag" behind them, which slows the plane. The wing section (fig. 5) is properly streamlined, and air flows smoothly under it and above it without causing eddies. Too steep inclination of any wing (fig. 4) produces a break-up of the air called "burbling." Here the lifting power of the wing is sharply reduced, the drag suddenly increases, and the plane may stall and plunge. Figure 7 is a badly streamlined fuselage, while Figure 8 is a well-streamlined example. The original method of maintaining lateral balance was to warp the wings in opposite directions (fig. 9). But now planes have flaps, called ailerons (fig. 10) inserted in the wing edges, which are controlled by a sideways movement of the pilot's "joy stick." The elevators are moved by a backward and forward movement of the stick (fig. 11). The steering rudder is turned by a crossbar which is operated by the pilot's feet. (fig. 12).



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PIONEER IN MILITARY AVIATION

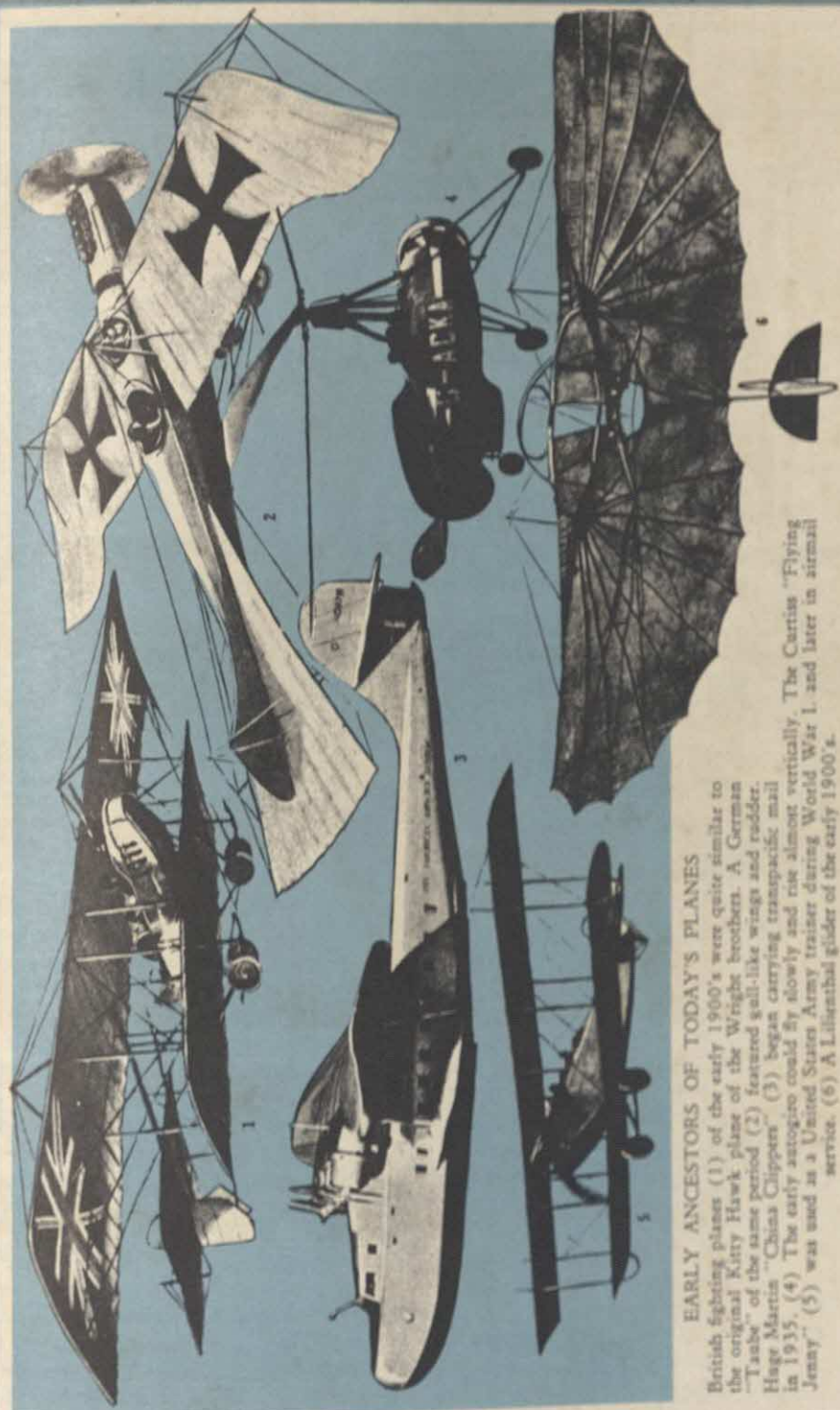
General William B. Mitchell (above) fought for his beliefs that airplanes could be used successfully to bomb warships. His ideas caused a great controversy. Nonetheless, in July, 1921, he flew his own plane in the bombing and sinking of the German battleship "Ostfriesland" to demonstrate that his theories were workable.



FORERUNNER

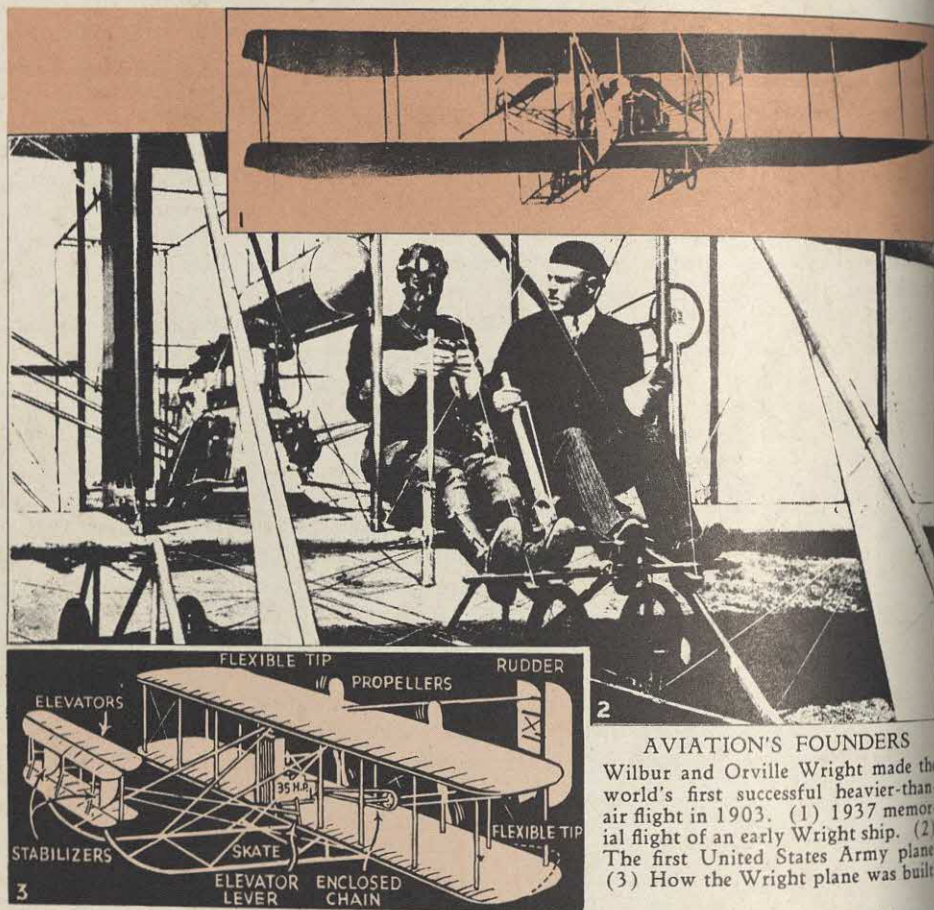
The twin-tractor biplane, left, is an earlier model of the one that Billy Mitchell flew.

Glenn L. Martin Company



EARLY ANCESTORS OF TODAY'S PLANES

British fighting planes (1) of the early 1900's were quite similar to the original Kitty Hawk plane of the Wright brothers. A German "Taube" of the same period (2) featured gull-like wings and rudder. Hoge Martin "China Clippers" (3) began carrying transpacific mail in 1935. (4) The early autogiro could fly slowly and rise almost vertically. The Curtiss "Flying Jenny" (5) was used as a United States Army trainer during World War I, and later in airmail service. (6) A Lillenthal glider of the early 1900's.



AVIATION'S FOUNDERS

Wilbur and Orville Wright made the world's first successful heavier-than-air flight in 1903. (1) 1937 memorial flight of an early Wright ship. (2) The first United States Army plane. (3) How the Wright plane was built.

above the ground was his dream yesterday.

The Beginnings of Flight. For the first experiments in flying, we trace the story of flight to that great Renaissance artist and scientist, Leonardo da Vinci. In his studio in Italy, Leonardo thought about flying and evolved some of the principles that are used today for making great streamlined airplanes fly. One of these was the principle of the propeller, for it was his theory that movement in the air could be obtained by action similar to that of a screw. He also invented the first parachute, a large, flat sail which would allow a person to jump from a high place and descend to the ground safely.

Leonardo was wrong, however, when he thought that man could fly like the birds, by using his own muscles for power. He

constructed artificial wings that would strap to the arms, and believed that by flapping these wings, it would be possible to ascend into the air. Borelli, an Italian, who continued the study of flight in the early seventeenth century, proved the fallacy of this principle, and evolved other theories that aided later scientists. Besnier, a Frenchman, added to the story of flight by constructing glider paddles which fitted to his arms and legs and allowed him to float to the ground from his garret window. But, despite these theories and experiments, man was not to lift himself into the air until the eighteenth century.

Lighter-than-Air Flight. To France goes the honor of being the first nation to see a flight made by man. It was in a balloon built by the Montgolfier brothers,

Jacques and Joseph, who had been experimenting with bags filled with hot air. In 1783, their first large bag, made of linen and lined with paper filled with hot air and smoke from a fire (they thought it was the smoke that made the balloon go up), ascended 1,000 feet. Next, they fashioned a basket in which they placed a sheep, a rooster, and a duck, and when these animals came down safely, they were ready to build a balloon for a man.

About the same time, a balloon constructed under the direction of J. A. C. Charles and inflated with hydrogen gas rose to a height of nearly 3,000 feet. In October, 1783, François Jean Pilâtre de Rosier went up in a balloon which had a grate attached so that he could keep the fire under the bag going, and in November, accompanied by another man, he made the first free flight in a balloon.

Two years later, Jean Pierre Blanchard and Dr. J. Jeffries, an American, drifted across the English channel in a balloon, and it was definitely established that man could fly, even though crudely and at the mercy of the winds.

Except for the introduction in 1783 of hydrogen as a gas for balloons, little progress was made in lighter-than-air flying until 1851. In the meantime, men tried to combat air currents and wind by using sails and oars made of feathers and cloth, but these attempts were in vain. In 1851, however, Henri Giffard constructed a cigar-shaped balloon to which a car and a steam engine were attached. He was able to travel from four to five miles an hour. This was the first dirigible. Because a steam engine was too heavy, it was almost useless in powering balloons, but it did prove that power was necessary if balloons were to move through the air regardless of the winds and currents.

Then, in 1901, Alberto Santos-Dumont, a Brazilian living in Paris, used a gasoline motor with the cigar-shaped balloon, and the way to future dirigible construction was paved. The difficulty of a single bag full of hydrogen was solved by Count Ferdi-

nand von Zeppelin in the first years of the twentieth century, by the construction of a large dirigible containing many compartments for the gas. From his construction of the first rigid airship grew the great monarchs of the air which we see today. The progress of lighter-than-air craft was furthered by the use of non-inflammable helium gas, and the development of high-speed powerful motors.

Free ballooning has continued, not only in international competition, but also in science. Daring adventurers of the air have soared more than 72,000 feet into the stratosphere in mammoth, specially constructed free balloons, and it is expected that higher flights will be made.

Heavier-than-Air Machines. While man has flown in lighter-than-air ships for over 150 years, his flight in heavier-than-air craft is numbered in a few decades; in fact, since the introduction of light, powerful gasoline motors. Before the Wright brothers made their first flight at Kitty Hawk, N. C., in 1903, experiments had been going on ever since the time of Leonardo da Vinci. Some of the most notable achievements included George Cayley's construction of biplane models in 1809, his theory of the cambered wing, and the model helicopter which used the aerial-screw principle.

In 1897, Clement Ader, of France, made a machine that flapped its wings and was powered by a steam engine. It flew, but it was wrecked on its first flight. Oscar Lilienthal was active at this time, experimenting with gliders, but he met his death before he could try a glider with a motor attached. Samuel Pierpont Langley was another early experimenter with airplanes, and might have received the credit given to the Wright brothers had his machine not been wrecked. But it was the flight of Orville Wright, on December 17, 1903, on the dunes of Kitty Hawk, N. C., that definitely established the heavier-than-air machine; and from then on, the progress of the airplane was speedy.

Today, airplanes are a common sight. They are being built safer and faster, and with the introduction of safety devices and

the development of scientific instruments they have become an indispensable means of transportation. They have also become vitally important in national defense.

Modern planes fly at speeds undreamed of by earlier airmen. The fastest military planes can fly at twice the speed of sound. Experimental planes can fly even faster for brief intervals. The chief hindrance to even higher speeds for longer periods is the heat barrier. Air friction, even in the stratosphere, would swiftly destroy planes traveling at three or four times the speed of sound. Engineers are now working to produce materials, designs, and appliances that will enable aircraft to travel in the "thermal thicket."

VTOL. Helicopter development has made vast strides. Helicopters proved their value in the Korean War, when they were used to evacuate wounded soldiers and rescued downed airmen from positions where conventional aircraft could not land. Helicopters fly by means of one or two rotating wings, or rotors. They can rise and land vertically, hover, move right or left, backward or forward, or turn a tight circle in the air. Their chief advantage is that they can take off and land in a small space. Some helicopters regularly make mail deliveries on the roofs of post office buildings. Slow speed is the chief defect of helicopters.

This defect has been remedied in other VTOL (vertical take-off and land) planes. Like helicopters, these planes can rise and descend vertically, hover, and move in any direction required in the air. A number of them fly at jet speeds. Some take off and land nose up, from the ground or from vertical platforms. Others rise and land in the horizontal position.

One of the most unusual of the VTOL planes is the aerodyne. This is a wingless plane that flies by means of fans that suck in air and blow it through louvers in the belly of the plane. It can be made to hover, or move as required, by moving the louvers. In the air, it can be driven by conventional jet engines.

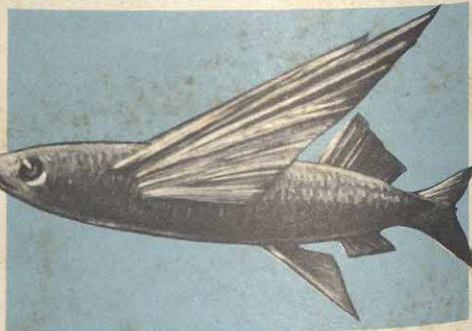
For additional information, consult the following articles:

Airplane	Langley, Samuel P.
Balloon	Lindbergh, Charles A.
Diesel Engine	Parachute
Dirigible Balloon	Transportation
Gas Engine	Wright, Orville and
Curtiss, Glenn	Wilbur
Zeppelin, Ferdinand von	

FLYING DUTCHMAN. According to a European legend, there is a phantom ship that is doomed to sail the southern seas forever. Long ago, it is said, a Dutch sea captain, attempting to sail around the Cape of Good Hope, was caught in a terrific storm at sea, and swore a terrible oath that, even though it took him until the Judgment Day, he would make the cape. For this oath it is his fate to sail the seas without rest.

Many superstitious sailors of the past declared that during a storm they had seen this phantom ship scudding before the wind. According to Richard Wagner's opera, *Der Fliegende Holländer*, based on this legend, the captain would be relieved of his curse if he could find someone willing to marry him, even though she knew his fearful fate.

FLYING FISH. By rapidly moving their tails in the water, the flying fish are able to throw themselves into the air, and with



THE ORIGINAL SEAPLANE

Flying fish can glide 200 yards at a swoop.

their large wing-like pectoral fins acting as a sort of parachute, they are able to travel sometimes for several hundred feet before dropping into the water. These fish do not really fly, but it is thought that their ability to leave the water enables them to elude larger fishes, such as the mackerel and the

dolphin. Similar to the true flying fish, but belonging to a different family, are the *fly-ing gurnards*. Both are small in size.

The best-known species of the flying fish is found in the open seas, along the coasts of Southern Europe and North America, and in the waters around the Hawaiian Islands. The *great* flying fish, eighteen inches in length, is found along the Southern California coast; and the *sharp-nosed* species inhabits the coasts of Central America.

FLYING SQUIRREL. Perhaps the first parachute-jumper known to nature, the strange little flying squirrel can glide through the air for a distance of sixty feet, but only in a downward direction. On each side of its fur-covered body there is an extension of the skin between the front and back legs; and when the squirrel leaps from the top of a tree, it stretches its legs to the sides, thereby extending this skin to serve for a parachute.

The flying squirrel spends most of the day sleeping, and comes out at night to hunt for its food. Nuts, leaf buds, and the eggs of birds are the principal articles of its diet, although sometimes, when it can obtain them, it will eat young birds. The flying squirrel found in the eastern part of the United States has soft gray and white fur and bright, beady black eyes. It is about five inches long, not including its long, bushy tail. The "flying marmot," or "flying cat," of India is a large flying squirrel. In Australia there is a pygmy flying squirrel.

FOG, or MIST. Ships at sea, traffic on land, and airplanes all find movement difficult and dangerous when a fog or mist blankets the region. Visibility is poor and often almost totally destroyed by these clouds of minute droplets of water. Dense fogs may cause accidents that become tragic catastrophes.

It is during a fog in a coastal city that we hear the low, monotonous moan of the fog buoys and the dirge of the bell buoys, as they warn passing ships of near-by invisible dangers. Boats must sound their fog horns



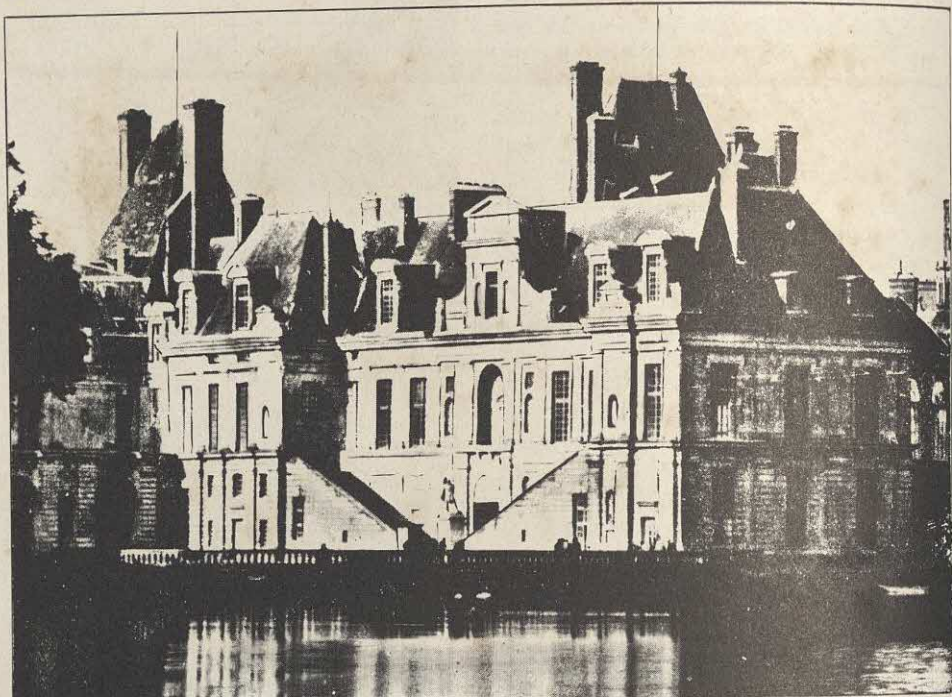
American Museum of Natural History

HE FLOATS THROUGH THE AIR
The flying squirrel uses the membrane between his legs to glide from branch to branch.

frequently to avoid collision; automobiles and trains are forced to move cautiously, with their lights on; airplanes are either grounded or required to fly "blind" with the aid of instruments.

Fogs and mists are formed by the condensation of moisture in the air due to a cold current, or to the presence of some cold object such as an iceberg. They occur frequently in regions where there are rapid changes in weather conditions during the day, as in San Francisco and London. There is little difference between a fog and a mist.

A fog is composed of minute droplets of water, and a mist contains particles of moisture only slightly larger. The appearance of the sun to warm the air, or the displacement of a cold current by a warm one, will disperse the earthly clouds. Sometimes, early on a summer morning, a mist may be seen



HERE MARCHES THE GHOST OF MANY A FRENCH KING

The imposing chateau of Fontainebleau was built by Francis I four centuries ago. It was long a favorite rural retreat for kings of France in the days of regal splendor.

in valleys of inland farm regions, but it disappears as the day wears on.

Fogs have had far-reaching results in the lives of men. It has been said that the policies of the British government have largely been influenced by the foggy London climate, which has taught Englishmen to be cautious and prepared. It has also been a great aid to aeronautical science, for, in order to combat the dangers of fog, men have been forced to exert their inventiveness to develop instruments that can replace the eyes of the aviator when necessary, and make possible what is called "blind flying."

FOLK'LORE. Long before people could write, they had accumulated a store of tradition. They were familiar with wind and weather, with life and death, pain and comfort, war, hunger, joy, and love. Their beliefs and customs relating to such common experiences they passed from generation to generation by word of mouth, thus preserving for us the great mass of native wisdom

and superstition called folklore.

In almost all lands, folklore persists to this day in the form of sayings, legends, fairy tales, and beliefs. Many of the traditions of different groups are so similar that they suggest a common origin. Numerous peoples, for instance, have a Robin Hood, a Jack the Giant Killer, and a Cinderella, as well as some form of Puck.

Historians, sociologists, and students of languages have in modern times made careful records of the folklore of nearly every people, from the aborigines of Australia to the Aleuts of Alaska, the better to understand the development of man's civilization.

FONTAINEBLEAU, *foN ten blo'*. Located in a beautiful forest of the same name, the town of Fontainebleau, long the home of French kings, lies about thirty-five miles southeast of Paris. As early as the twelfth century, Louis VII occupied a fortified chateau in this forest, but it is not known by whom it was built. Later, it was made

The GOOD EARTH

Feeds Her Millions



over into a great palace by Francis I. Each succeeding king altered and greatly enlarged it, so that it was not completed until the eighteenth century. The palace is situated in the midst of a vast park that is laid out like a garden and contains fountains, waterfalls, lakes, and beautiful temples and statues.

FOOD. Nothing is of greater importance to man than food, for without it he would soon perish. Should he be shipwrecked and cast upon an uninhabited island, one of the first things he would do would be to search for food and water. Indeed, the foremost primitive instinct of man is self-preservation, and food represents the prime means of carrying out this instinct.

The history of the world could almost be called the history of food, for its abundance or scarcity has been responsible for the development of civilization. In the Nile Valley, in Africa, the ease with which the Egyptians could grow crops to feed themselves gave them time to turn their attention to other things. Thus, they invented a system of writing; they wove cloth, built pyramids and temples; indeed, in the Nile Valley the first great civilization had its birth.

In Western Asia, in the fertile valley of the Tigris and the Euphrates rivers, another ancient civilization developed, and it was for the possession of this source of plentiful food that the Assyrians fought the Babylonians, and the Chaldeans fought the Assyrians.

The Greeks and Romans developed great nations because the need of more food spurred these energetic peoples to expand the territory of their homelands. Crops sufficient to feed all the people could not be grown in Greece, and Greek settlers founded colonies in other parts of the Mediterranean shore, where wheat could be grown and shipped back home. Rome, too, needed great supplies of grain to feed her vast army of slaves and impoverished freemen, and so she conquered country after country in an effort to augment the food supply.

In the early part of the Christian Era, vast hordes of Goths, Huns, and Vandals swept through Europe to seek lands where food was plentiful. These migrations resulted in the final collapse of the Roman Empire, the growth of feudalism, and the birth of the modern European nations.

One of the reasons why civilization stood still during the Dark Ages was that, through ignorance, men wasted the fertility of the soil, and it was difficult to secure food for the overcrowded population. People had no time for education and culture, because they were too busy trying to grow enough food to keep themselves alive.

Nations that have plenty of food are contented and happy, but people who are hungry will usually seek some way of obtaining it, rather than perish from starvation. In France, in the eighteenth century, the peasants and middle class were hungry. Unjust taxation and autocratic rule by the aristocrats robbed them of their food. Driven to desperation, they overthrew the government that robbed them, in a bloody Revolution that made all Europe tremble. In Ireland, where potatoes are the chief staple, a severe famine in the nineteenth century caused a shortage of food, and hundreds left their homeland for the United States, where food was plentiful. Shortage of food was responsible for the emigration of many other peoples to America.

Food is one of the causes of war. Today in Europe, many countries are overcrowded, barely able to feed their populations. The situation is considerably worse in Asia. Economic pressure on the vastly overpopulated island empire gave Japan a reason for the march of conquest which led to World War II in the Pacific. The success of Communism in some parts of Asia has resulted in part from the readiness of hungry people to follow any political party which promises them food.

The common fruits, grains, spices, and vegetables, and animal products used as food, are described in these volumes under separate headings. See, also, **AGRICULTURE**; **DIET**; **COOKING**, and kindred topics.

FOOT. When the ancients wished to establish a measure of length that could be used by all, they decided upon the human foot as a standard unit of measurement. Since human feet are not all the same length, this was not an accurate measure; so the Greeks adopted a foot that was 12.1

inches long. The Macedonian foot was 14.08 inches long, and the Pythian foot, 9.72 inches.

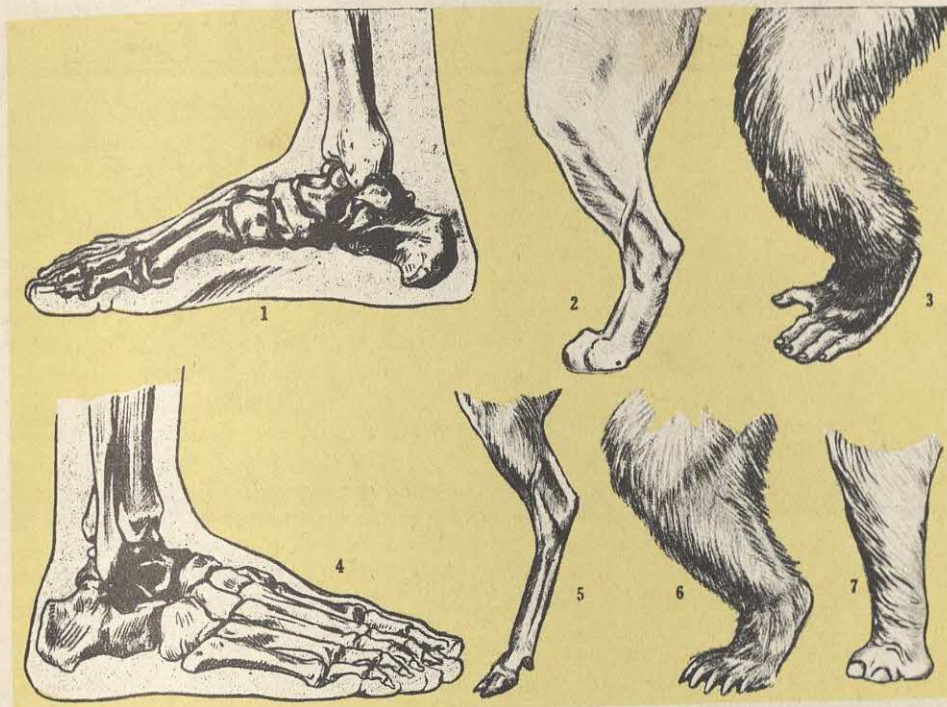
According to legend, Henry I made the length of his arm — thirty-six inches — the standard yard. It was to equal three feet, which fixed the length of the foot as twelve inches. The foot is the unit of linear measure; the square foot, of square measure; and the cubic foot, of cubic measure. The square foot (12x12) contains 144 square inches; and the cubic foot (12x12x12), 1,728 cubic inches. See **MEASUREMENTS**.

FOOT, THE. The part of the body which enables an animal to stand and move about is commonly called a foot, whether it is a fleshy or bony structure. In the ordinary use of the term, however, the feet are the lowest extremities of the legs, and are composed of bones covered with skin, being strong enough to support a body. In clams and insects the structure differs from other forms such as are found in the higher animals and in man, where that part of the body is very highly developed to perform a number of more or less strenuous duties.

When the clam wishes to move about, it protrudes a muscular mass from its shell which pushes the little animal away from the spot where it is. In some insects it may be almost impossible at times to distinguish between the leg and the foot. The foot may appear to be simply an additional joint of the leg. The fly has sucker-like hairs on the feet, enabling it to walk upside down on the ceiling.

Feet in Higher Animals. As higher forms—reptiles, birds, and mammals—are studied, interesting feet, composed of bones, are found. Some are adapted to running, some to climbing, others to swimming, and so on. In the frog and toad, the foot is larger and has five toes, with no nails, the toes being webbed for swimming. The turtle's foot almost resembles a paddle and is used as one when the animal is in the water. The flipper of the seal is a bony and fleshy structure adapted for swimming.

The familiar woodland animals, such as woodchucks, moles, and badgers, have



PURPOSEFUL PEDALS

(1) Bones of a man's right foot, inner side; a locomotive member. (2) Lion's retractile-claw foot. (3) Gorilla's seizing foot. (4) Outside of man's foot. (5) Speedster's leg—a deer's. (6) Bear's bracing foot. (7) Weight-bearing elephant's leg.

feet which not only help them to move around but to burrow into the ground. Cats have padded feet which enable them to walk silently. They also have claws for climbing and catching food. The horse has one large toe or hoof, developed for speed in walking and running.

The feet of birds offer many interesting variations. Some, such as the duck, are equipped for swimming. The woodpecker climbs with long, strong, grasping feet. The heavy, clumsy foot of the ostrich enables him to run swiftly and to defend himself by kicking. Everyone is familiar with the sight of a hen scratching for food with feet which are constructed for the purpose. The feet of most birds are designed by Nature for grasping branches of trees.

Human Feet. Like the feet of birds, animals, and insects, the feet of man are designed to serve him in the most satisfactory

manner. Inasmuch as human beings spend much of their time in an erect position, the human foot is strong and equipped to absorb shock and maintain balance. In man the foot extends from the ankle joint to the end of the toes. It is composed of the *tarsus*, or ankle, which is made up of seven bones; the instep, or *metatarsus*, made up of five bones; and the five toes (*phalanges*), each containing three bones, except the large toe, which has only two. The instep, the arched part, appears in that form only in man, and besides adding grace to walking, eases the jars which might affect the sensitive spinal column.

Inasmuch as the foot is one of the most necessary parts of the body, it should be carefully protected from shoes that are too tight or which fail to give proper support. The foot works hard for man, carries many pounds of weight each day, and should be treated always as a friend. See BONE; HAND.

GRIDIRON STRATEGY



Courtesy The Athletic Journal

FOOTBALL. The greatest sports spectacles of the fall season in the United States are football games played by college and high-school teams. Each fall sees thousands of youths of all ages racing up and down "gridirons," and more thousands attending the big games in stadiums seating from 5,000 to 100,000 persons. From September to the end of the year, the sport pages of newspapers devote millions of words to the games, records, and progress of teams and players, and all other forms of athletics are subordinated to football when the season is in full swing.

Football has progressed far from the days when the game was an informal pastime played on a yard with only a few spectators. Then, no admission was charged, the players "chipped in" for a ball, and uniforms consisted merely of old clothes. Today, the season's gate receipts for all colleges supporting football teams amount to millions of dollars. The stadiums, built with the aid of bond issues, are financed by large corporations, and colleges are able to support other sports through the funds obtained from football.

In addition to the financing of less popular intercollegiate athletics and intramural activities, football also brings great publicity to colleges and universities. Such publicity

usually results in the attraction of more students, and thus an increase in revenue which enables the institution to equip its educational plant more fully. Football, more than any other sport, affects the entire higher educational system of the United States. Yet, just because football brings in so great a revenue, it has led to methods of attracting good players that have frequently aroused criticism.

The Race for Championships. Many of the major universities and colleges are grouped in conferences which award championships each year to the football team with the best record. Competition is usually very keen in the Western (Big Ten), Pacific Coast, Southwest, and Southern conferences. The Eastern teams do not have a formal organization, being informally grouped under the heading of the "Ivy League." But all teams have their annual "big" games with traditional rivals. Some receive nationwide publicity and are heard and watched by millions of radio listeners and television viewers. Others are of only local interest, but the students, alumni, and fans who attend these minor games have all the enthusiasm of the crowds at the more famous contests.

Some traditional games usually have a prize attached; for instance, the winner of



Courtesy The Athletic Journal



FOOTBALL REQUIRES TEAMWORK OF THE HIGHEST ORDER

The runner (left) couldn't gain if his teammates didn't "take out" defense men (right).

the annual Minnesota-Michigan game receives "the little brown jug," a historical but valueless relic of earlier years. Purdue and Indiana universities meet annually for the "old oaken bucket."

Other big games every year include the Rose Bowl game in Pasadena, Calif., between the champion of the Pacific Coast Conference and a selected Eastern or Mid-west representative, played on New Year's Day; the other "bowl" games throughout the South on the same day; the Army-Navy game between the teams of the government Military and Naval academies; decisive Big Ten clashes; and the All-Star game in Chicago in August, which brings together popularly selected college stars of the previous season and the champion team of the professional league.

Professional football has become exceedingly popular in recent years, drawing its players from former college men, and playing before large crowds on Sunday afternoons. The championship is determined by a game between the best Eastern and Western teams.

In every state, there are also high-school conferences and leagues. Frequently, games are held between high schools of one geographical section and another, as in collegiate football.

How the Game Is Played. Football no longer is merely a sport, but a scientific test of strategy as well. Rules are changed frequently, and methods of playing have become complicated and varied. Since the turn of the century, the game has seen the development of the *pass* as a weapon of attack, where formerly strength and power dominated the play. *Forward* and *lateral* passes have made offensive football a swift and exciting game, resulting in greater spectator interest. With the development of the game, and because the goal posts have been set farther back than they were in the early days of the sport, the *drop kick* has disappeared largely in high-school and college football, being replaced by the *place kick*, which calls for two men, one to hold the ball and the other to kick it.

The game is played on a field 100 yards long, and 160 feet wide. The length is meas-



Courtesy The Athletic Journal

THERE ARE RIGHT AND WRONG WAYS TO PLAY

Left, illegal and legal block: the lineman at the left will be penalized for hooking his arm around his opponent's leg. Right, both play the ball, but it looks like "interference."

ured off in five- or ten-yard spaces, extending from the goal lines at each end of the field. In college and high-school football, the goal posts are set ten yards back of the goal lines, while in professional football they are on the goal line.

A team consists of eleven men. Their uniforms consist of cleated shoes; specially designed pants which protect the knees, thighs, and hips; a jersey with numbers on the back and front and shoulder guards underneath; and a leather helmet. The ball is ovoid in shape. The positions on the team consist of a *center*; two *guards*, two *tackles*, and two *ends*, who compose the *line*; and a *quarterback*, two *halfbacks*, and a *fullback*, who make up the *backfield*. Officials include the *referee*, *umpire*, *field judge*, *linesmen*, and *timekeeper*.

The game continues for sixty minutes of playing time, divided into four *quarters* of fifteen minutes each, with an intermission of fifteen minutes at the middle of the game and one minute between the first and second and the third and fourth quarters. To start the game, the referee calls the two captains together and tosses a coin. Whoever wins the toss may elect the goal his team wishes to defend, or to make the kick-off or

receive. Should he make the choice of a goal to defend, the other captain may elect to receive or make the kick-off.

The team making the kick-off lines up on its own forty-yard line. The ball is kicked off the ground, and the defenders charge forward. The team receiving the ball is spread out over its half of the field, and when the ball is kicked, one man attempts to run it back while the other ten men seek to block the opponents from tackling him. Usually the runner is tackled before he progresses very far, but sometimes he is able to run to the opposing team's goal line for a *touchdown*. If he is downed in the field, his team has the ball, and is required to advance ten yards in four *downs*, or make a score. If the ball is carried the required ten yards or more in the four downs, the team keeps the ball for another four downs. Should it fail, the ball goes to the other team.

To advance the ball, the offensive team may use the *line plunge*, in which a backfield man attempts to go through the line; an *end run*, in which he seeks to advance by running around the ends of the line; a *forward pass*, in which one man throws the ball forward to a receiver some distance

ahead, or a *lateral pass*, in which he throws it sideways to a waiting runner.

When a team has the ball in its own territory, that is, nearer to its own goal line than the other team's, it will usually attempt to gain on running plays in the first three downs. If this attack fails to gain the ten yards, it will *punt* (kick) the ball in the direction of the other team's goal in order to keep the ball as far from its own goal as possible. Although the use of the pass has become much more liberal in recent years, long or complicated passes are usually not attempted unless in midfield or in the other team's territory.

When a touchdown is scored, the team making it receives six points. The ball is brought out to the two-yard line and the team that has made the touchdown tries for an *extra point*, usually by a place kick. If the ball goes over the crossbar and between the uprights of the goal posts, an extra point is added to the score. However, the team may elect to try a drop kick, or a pass, or run with the ball for the extra point. In the case of a pass or run, the ball must be downed over the goal line. If a place kick

or drop kick is successful from the field during the ordinary course of play, three points are given the team making the kick. Should a team be forced to down the ball behind its own goal line, two points are awarded the other team for a *safety*.

Qualifications of the Players. Because there are so many variations in attack, and so many methods of counteracting the attack, coaches are employed by schools and teams to design plays, drill the players in fundamentals, and inspire teamwork and co-operation, which are essential to good teams. Good football players must have a thorough knowledge of the basic principles of football. Line plungers must be able to develop power and speed at an instant, run with knees high and head down, and keep a firm grip on the ball to prevent a fumble. Those who excel in running must be fast and shifty, capable of evading tacklers and darting through openings in the defense. Passers must grip the ball firmly, placing the fingers over the laces of the ball, and throw with a powerful overhand motion that makes the ball travel accurately and far in a spiral.

WHAT GOES UP MUST COME DOWN

The ball carrier is in for a long fall, as his blocker fails to prevent a defending player from making the grab that sends him flying.

Acme Newspictures





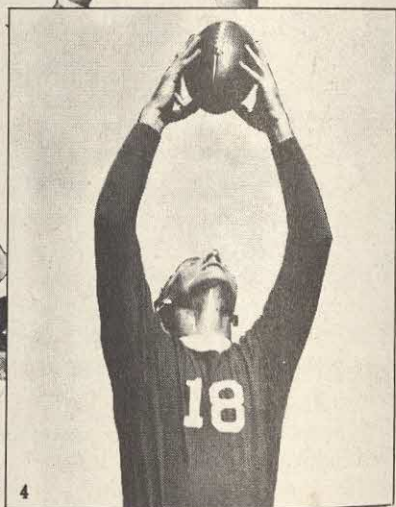
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Courtesy The Athletic Journal

SPECIALISTS PLAY FOOTBALL

Each player has a definite duty in each play, yet must obey the rules. (1) Legal position on the line of scrimmage. (2) Shooting the ever-dangerous pass. (3) Center's ideal position. (4) Snaring a high one.

A kicker must learn to punt the ball on a straight line—to take advantage of the wind and place the ball so that when it lands it will be to his team's advantage. Backfield men who excel in running, passing, and kicking are known as "triple-threat" players. On the offensive, linemen must prevent opposing players from breaking through and tackling the man with the ball, and also are called upon to open holes through the other team's line for their backfield men.

The center's job combines these two duties with passing the ball accurately to the backfield men on a given signal. All players should know how to tackle hard, preferably around the thighs, with a lunge that

will throw the man with the ball off his feet. They should also know how to block opposing men by throwing themselves in front of would-be tacklers and forcing them to fall.

When on the defensive, the linemen attempt to push the opposing linemen away and break through to tackle the runner or block a kick. Backfield men back up the line on defensive play, and also are required to tackle, and intercept or knock down passes. The quarterback, or some other backfield man, calls the signals for the plays agreed upon in the *huddle* previous to each *scrimmage*, or play, and also plays *safety*, some distance behind the line when the other team has the ball.

Penalties. These are awarded whenever one team or player violates some rule. The most common penalty, five yards, is imposed when a lineman is offside; that is, when he starts to charge before the ball is snapped. There is another penalty of five yards when an offensive backfield man is in forward motion before the ball is snapped, since the rule is that he may not advance until the ball is passed. Penalties also are inflicted for holding a man who does not have the ball, for "clipping" (dropping anyone but the ball carrier from behind), unnecessary roughness, wasting time between plays, and other violations.

Stars of the Gridiron. Throughout the history of football, great players, teams, and coaches have been developed and have come to rank as standards of excellence in the sport. A few great stars of the past were "Red" Grange, of Illinois, whose famous number "77" is known wherever football is played; "Pudge" Heffelfinger, whose prowess marked the early days of the sport; Walter Eckersall, the University of Chicago's great backfield star; George Gipp, of Notre Dame; the "Four Horsemen," of the same school; Ernie Nevers, of California; Benny Oosterbaan and Benny Friedman, the noted forward-pass combination of Michigan; Jim Thorpe, an Indian; and Pat O'Dea, one of the best kickers in the history of the sport.

Colleges and universities in every section of the country have produced brilliant teams of lasting fame. Some schools, such as Notre Dame, have achieved a succession of undefeated seasons; others look back upon one or more years of football supremacy. Some of the best-known coaches of the sport have included A. A. Stagg, Knute Rockne, Fielding Yost, Robert Zuppke, Howard Jones, "Pop" Warner, Earl Blaik, and Frank Leahy.

Football's Cousins. The game of football originated about 1850 among English schoolboys. It took two variations. One of them was called *rugby*, and featured running with the ball and tackling the runner. It became the modern American game and

English rugby football. The other variation, called *association football*, or *soccer*, prohibited the use of the hands. Except for the forward pass, interference, and methods of lining up, rugby is similar to American football. Soccer, however, is played with a round ball, and the goals do not have up-rights extending above the crossbar.

The object of the game is to kick the ball between the goal posts and under the opponent's crossbar. The ball must be advanced by kicking and butting it with the head. Excluding the goal keeper, a player's hands must not touch the ball except in throwing it in from out of bounds.

Each of the two teams has eleven players: goal keeper, right and left fullbacks, center, right and left halfbacks, and five forwards. The field has a middle circle ten yards in diameter, and a penalty area surrounding the goals.

Soccer is played extensively in the United States, but has not nearly achieved the popularity of football. It is in England and other foreign countries that it is played most, and there it attracts large crowds in stadiums similar to those in American colleges and cities.

FOOT POUND. In English-speaking countries, engineers measure work or power in foot pounds. Work, in the science of physics, is moving or lifting something against an opposing force. When a weight of one pound has been lifted through a distance of one foot against the pull of gravity, one foot pound of work is said to have been done—or when any other work is accomplished which requires the same amount of energy. If a pail of water weighing twenty-five pounds is pulled out of a well twenty feet deep, twenty times twenty-five, or 500, foot pounds of work are done. A machine which can do 33,000 foot pounds of work every minute, whether lifting or engaged in other work, is said to have a strength of one horse power. See HORSE POWER.

FORCE. Any cause which either changes or tends to change the motion of a body or its condition is a force, in the science of physics. Load, thrust, push, pull, pressure,

tension, attraction, repulsion, effort, and resistance are particular kinds of force.

Force is the direct cause of the change in the motion of a body. According to Sir Isaac Newton's first law of motion, a body never changes its state of rest or of motion unless there is a force to bring about the change. One must be careful to use the term *force* correctly. The wind that makes the windmill turn is not a force, but the push of the wind against the blades of the wheel is a force. A moving bullet is not a force, but the impact of the bullet against a wall is a force. A stretched spring is not a force, but the pull that tends to draw the ends together is a force.

Every body on the earth is pulled toward the center of the earth by a pull called *gravitational* force. Weight is the measure of gravitational force. Therefore it is convenient to measure other forces in pounds or other units of weight. Thus, it may be said that it takes a ten-pound force to lift a ten-pound object. But this measurement is not strictly accurate, because the weight of an object varies with its latitude and altitude. So for strictly scientific purposes, force is measured in absolute units. In the metric system the absolute unit of force is the *dyne*, which is the force that will produce an acceleration of one centimeter per second in a mass of one gram (see **METRIC SYSTEM**).

It has been said that one of the greatest events in the history of the world was primitive man's discovery of the wagon wheel. How much difference the wheel makes in our work we may realize in part by comparing the efficiency of the wagon and the stoneboat. The wheel conserves time and labor and makes otherwise impossible tasks possible because it utilizes forces to good advantage.

All the machines and mechanical devices in the world are merely elaborations and combinations of the *six simple machines* described in the articles **INCLINED PLANE**; **LEVER**; **PULLEY**; **SCREW**; **WEDGE**; and **WHEEL AND AXLE**.

FORD, HENRY (1863-1947). Known as the man who put America into automo-

biles, Henry Ford became one of the richest men in the world through the manufacture of low-priced cars. He was born in Greenfield, Mich., and started life as a poor farm boy. In 1887 he moved to Detroit, where he began learning the machinist trade; as a result of his skill in this type of work, he soon became chief engineer of an electric-light company. After years of work with the gasoline engine, he founded the Ford Motor Company in 1903. Then began a fabulous career, in the course of which Ford produced millions of cars and adopted mass-production methods which helped to revolutionize American industry. He relinquished control of the company to his son Edsel in 1919, resumed the presidency on Edsel's death in 1943, and left it permanently in 1945, when his grandson, Henry Ford II, took charge.

FORD FOUNDATION. Originally founded in 1936, the Ford Foundation was enriched by the estates of Edsel and Henry Ford and became the world's greatest philanthropic trust. Its ambitious goals include working for peace and for democracy, for the improvement of education, and for human betterment. The Fund has distributed millions of dollars for a great variety of projects and programs in many parts of the world, ranging from awards to American school teachers to technical aid to countries of the Middle East.

FOREIGN MONEY. See **COINS AND COINAGE**.

FOREIGN TRADE. In the family of nations, foreign trade is as important as the commercial relations between cities or between the states. Living conditions in our modern world are so complex that the people of any one country depend on various other countries for many necessities of life, using completed products or materials essential to their preparation. The United States, for example, imports tea and coffee, spices, silk, and much of its cane sugar. It exports to countries of limited industrial activity, numerous manufactured products.

The desire to speed up the interchange of products was the incentive of many of

the early voyages of discovery into the Orient and the New World, but people of the sixteenth century little realized the future possibilities of world commerce.

Today there is a close relationship between foreign trade and the peace of the world, although, since the rise of world Communism, political aggression has partly replaced the economic aggression of earlier periods. The major nations of the world for the past two centuries have sought and fought to retain a favorable *balance of trade*; in other words, they desire to sell more goods than they buy. As commerce between nations increased, theories of how to maintain a favorable balance of trade developed.

There are two schools of thought: one group favors free trade and the other government regulation of imports. Foremost among the free-trade thinkers was Adam Smith (see SMITH, ADAM). Of recent years, the policy of government control or aid to trade, in subsidies to exporters and tariffs to injure importers, has come to the fore. Beginning in 1934, reciprocal trade agreements between the United States and other countries tended to reduce tariffs; and after World War II there was a trend toward tariff reduction and the elimination of trade barriers. See FREE TRADE; TARIFF.

FORESTER SOCIETIES. Among the many fraternal bodies in the United States organized for the purpose of supplying insurance and other benefits to their members are the three forester societies described below. Of these the first is the largest, with a membership approaching 2,000,000; the other two are much smaller. See FRATERNAL SOCIETIES.

The society called the Ancient Order of Foresters was founded in 1745 in Yorkshire, England. It was organized as a fraternal society, the purpose being to bring benefits to its members. Each division of the order is called a court, and the first in the United States was organized at Philadelphia in 1832. There is also a branch in Canada. Millions of dollars are given in benefits each year.

Another forester society is the Independent Order of Foresters, founded at Newark, N. J., in 1874. Each year this society also disburses millions of dollars in benefits.

Of still later origin is the society called the Foresters of America. At first it was a part of the Ancient Order of Foresters, but a group broke away from the parent society to form an independent organization. It became a separate and independent American fraternal organization in 1889.



Rognon Photo; American Forest Products Industries

FELLING A BIG ONE

A modern Paul Bunyan attacks a giant pine.

FORESTS AND FORESTRY. Paul Bunyan, mythical king of the lumberjacks, lived in a land of majestic beauty and splendor. With his gigantic pet and beast of all work, Babe the Blue Ox, he strode the purple mountains and green valleys, scooped up crystal lakes for a drink, and used Douglas-fir trees for toothpicks. His entire domain was covered with tall timber. Trees were everywhere; rippling streams flowed through the dark, cool forests and never



U.S.D.A.



U.S. Forest Service Photo

THE GREAT RED ENEMY OF THE FOREST

Raging forest fires (top) cause great annual losses of trees and other plants, money, and wild-life. Nearly all are caused by carelessness or arsonists. In most heavily forested areas, fire detection observers keep a constant vigil for signs of smoke and fire. A forest guard (above) uses a fire finder. By lining up the sights across a circular map of the forest area, he can locate a fire. He notifies an information center from which fire fighters are dispatched on foot, by truck, and by airplanes carrying fire jumpers equipped with parachutes.

dried up. There were no droughts or desolating dust storms; and deer, moose, and other wild game roamed the serene, virgin wilderness, providing ample food for the fabulously hungry crew that worked for Paul. High above the strong and hard-working woodcutters, birds of all kinds nested, furnishing song and color in the swaying branches of the trees.

Such a man as Paul lived only in the fancy of northland lumberjacks; and, unfortunately, such a marvelous land as his is

known today almost solely in stories. But the forests that Paul once ruled really did exist. There are a few isolated places where they still remain—remnants of Paul's trees, rivers, and lakes which once composed the Northern United States.

Today such lands are almost gone. Instead of forests, there are farms; instead of well-fed streams, there are many rivers that dry up every summer; and instead of deer and moose there are cows and chickens. Dust storms and drought have become nat-

FORESTS AND FORESTRY

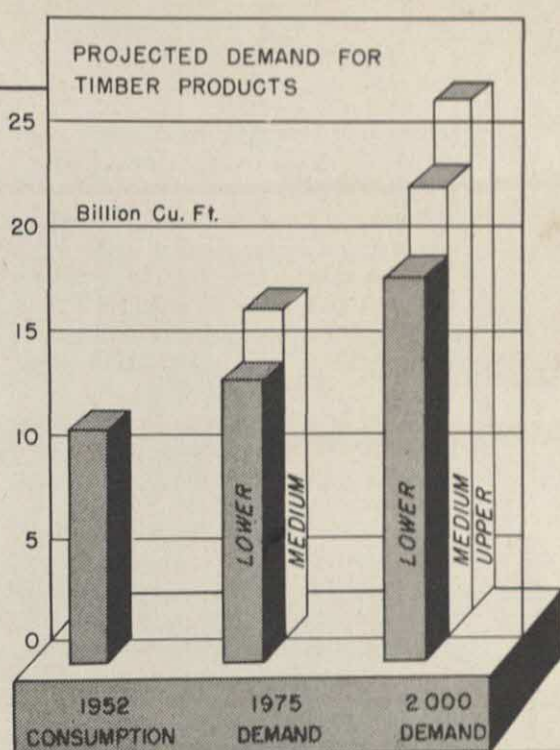
ural enemies of man instead of rare disasters, and valleys and hills stripped bare of trees are being washed away. The land of Paul Bunyan and the forests of the United States were once the same. Today they are not, and we are beginning to realize what a bountiful country we have been wasting.

The Friendly Forests. Man obtains many things from forests. The pine forests give him lumber for building material; spruce and hemlock provide pulpwood; maple and oak offer veneers; almost all trees can be made into railroad ties; red cedars make shingles for house roofs; unused wood is fashioned into laths; hemlock, oak, and the quebracho of South America are all important sources of the tannin necessary for tanning leather; the pine of the South yields cellulose; also resin, tar, pitch, and turpentine; cedar and cypress go to make telephone and telegraph poles; wood from many trees becomes cellulose, the valuable substance from which man makes countless necessary articles and chemicals; nuts and fruit from trees of the forest give foods, and many provide bases for medicines.

But the value of forests is not limited to the things that can be obtained from trees. Forests left standing serve as sponges for the rain, absorbing moisture and storing it in the soil. The roots of trees hold soil together so that it will not wash away; and the shade of forests lowers the temperature of the air close to the ground, keeping moisture in the air and thus making more rainfall.

Forests keep small streams well supplied with water by preventing gullies and rivulets from forming, thereby aiding farmers and hydroelectric-power plants which depend on a steady supply of water. Forests break the force of the wind, protecting man's dwellings and property; and they provide shelter for game animals. In addition, they are resorts of health and quiet, and an endless source of beauty.

Forests of the World. Despite the waste that has characterized man's use of wood, there are still some large forest areas in the



USES FOR OUR FOREST CROP

Although the use of wood for fuel is constantly decreasing, the demand for pulpwood products, veneer logs, and lumber is always increasing. The estimates shown here—lower, medium, and upper—vary to make allowances for possible future substitution of other products for wood.

world. In the cold, temperate zones are found the cone-bearing trees—pine, spruce, and hemlock—and beech, maple, birch, and a variety of hardwood trees. In the warm, temperate regions are the oak, maple, cottonwood, cypress, and pine. The tropical forests include date and coconut palms, mahogany, teak, cedar, and other similar trees.

Asia's forests are concentrated in India and near the Himalayas and in Siam, Burma, Northern China, and Siberia. Russia, Germany, Switzerland, Czechoslovakia, Austria, Hungary, and the Scandinavian countries are the principal European forest lands. South America and Africa have vast areas of untouched forests, but the largest timber area in the world is in North America. Canada alone has an estimated 1,220,000

square miles of commercial timber, consisting of spruce, hemlock, cedar, tamarack, poplar, balsam, and firs.

Forests and woodlands still cover about one fourth of the land in the United States. They are divided into three regions: Eastern, Great Lakes, and Western. In the East, stretching from Maine to Maryland, are found such soft woods as white pine, spruce, hemlock, and fir; and maple, beech, birch, and a few other hardwoods. South of Maryland through the Gulf states are large areas of yellow pine, cypress, oak, ash, and other hardwoods.

The Great Lakes forests, reaching from the Red River of the North to the Appalachian Mountains, once were thought to be inexhaustible. But today the states of Wisconsin, Michigan, and Minnesota have been cut over, and only a fraction of the once-proud stands of white pine, spruce, and some hardwoods remains.

The Western states now have the most valuable forest lands. From the Great Plains to the Pacific coast, and from Canada to Mexico, pines and other cone-bearing trees cover the foothills of the Rockies and grow on the mountains themselves up to the tree line. From the Sierra Nevadas to the ocean, the tallest and oldest trees in the world are found growing. Here are the giant redwoods, the Oregon pines, the stately Douglas firs, and the sugar pine. The states of Washington and Oregon are the home of the Douglas fir, and California boasts the giant sequoias and redwoods.

Alaska has abundant forests of valuable timber, but the trees are considerably smaller than those in the United States because of the colder climate. Far out in the Pacific, the Hawaiian Islands have large forested areas.

Spending and Saving the Forests. It is only recently that the people of the United States have awakened to the fact that if forests were to be destroyed as wantonly as in the past they soon would be gone. For a long time, more timber was being destroyed than was being replaced by Nature; and it was apparent that, by the end of the

twentieth century, all the timber in the country would have been used up. That condition has been changed somewhat, and today the forests are being conserved through the activities of the United States Forest Service (a branch of the Department of Agriculture) and by the regulations of states, counties, cities, and private owners. But this system of regulating and conserving forests, known as forestry, is still far from perfect, and the forest lands are still being destroyed faster than they are being replaced.

Why the Forests Have Been Destroyed.

Waste has been the principal reason for the destruction of forests in the United States; for, when the country was growing up, no one thought of the future. All the trees could never be cut down, people said, yet the states of Minnesota, Wisconsin, Michigan, and others bear mute testimony to the opposite view. True, these states still have some stands of beautiful forests, but contrasted to them are the vast areas of cut-over land that is useless today.

Why were the forests destroyed so wastefully? First, because the people who settled the United States were farmers, not woodsmen. When they built their homes among the trees, the only way they could obtain farm land was by chopping down the trees. They also burned wood for fuel. Thousands of valuable trees went up in smoke as the frontier was pushed west. Then, too, the forests harbored wild animals and savage Indians. If the trees were destroyed, the Indians and animals would move on, and the homes and families of settlers would be safe. Naturally, wood had to be used for shelter and fuel; so there was another reason for the wanton destruction. After the Civil War, especially, the desire for wood was dominant; and, in the spirit of the times, men bought up lands or simply took them, cutting down trees and never replacing them. When they had destroyed one forest, they moved to another.

Fire is another cause of the destruction of forests. Every year thousands of square miles of valuable timber are destroyed by



American Forest Products Industries

A HELPING HAND

Every day the forester fights for the lives of tiny trees. From the moment the little seedlings sprout from the forest floor, he is constantly on guard against animals, insects, diseases, winds, and fires that might attack and destroy them.

sparks from campfires, cigarettes, locomotives, and lightning. The danger from fire is one of the reasons why no one is allowed to settle in national forest preserves and why warning signs are placed throughout state and national forests.

Disease and insects also cause great destruction. Trees are attacked by plagues just as are human beings, and the men employed in Federal and state forestry organizations constantly strive to find cures. Some insects and parasite plants kill trees, and the battle to save the forests is being waged along this line, too.

How the Forests May Be Saved. Methods of fighting the waste and destruction of timberland are not new, for forestry was practiced by the Germans as long ago as

the twelfth century. In those days, foresters went through the woodlands, marking trees that could be cut, planting new ones, and seeing that the people obeyed the laws. Such regulations are still carried on in Germany and other European nations, accounting for the fine stands of timber there. The people are taught not to waste wood and to be proud of their forests. This is exactly what the lovers of American forests are preaching in the United States.

The greatest service in conserving forests is performed by the United States Forest Service, which was founded in 1880 but did not come into complete authority over government lands until 1905. Divided into eight branches, it has offices in Missoula, Mont.; Denver, Colo.; Albuquerque, N.

M.; Ogden, Utah; San Francisco, Calif.; Portland, Ore.; Washington, D. C.; and Juneau, Alaska.

Stations are located throughout the national forests, where trained observers are continually on the lookout for telltale puffs of smoke that indicate dread forest fires. Rangers traverse the forests, caring for the trees and animals, enforcing the forest laws, and supervising the restricted logging that is allowed on government land.

The Service also maintains nurseries where seeds are nurtured into trees to be transplanted. Farmers and private landowners are given seeds and advice on growing and caring for trees; and laboratories are maintained for studying the uses of wood, the causes of disease and insect plagues, and methods of eliminating such plagues. The 160 national forests are well cared for through the Forest Service.

When the lookout in his tower observes a fire, he immediately telephones the nearest station, and men are mobilized to fight the fire. In the case of a *crown* fire, in which the flames leap from branch to branch, trees are felled in its path so that when the blaze reaches the open part, it will die out. *Surface* fires are fought by man-made fires which are kept under control, and by special apparatus. Airplanes, too, have been found useful in fighting fires. To prevent as much damage as possible, lanes are cut through forests by chopping down trees and brush. Thus, when a fire reaches the lane, it will be unable to cross. But the best prevention of fires is taking care that all campfires are extinguished when not being used, and that no one throws lighted matches or cigarettes into the woods. Most forest fires are the result of man's carelessness.

Many states also have created forest preserves, maintained along the same lines as the Federal forests. The states are also taking over idle property that has been sold for taxes, and are planting it in trees. Parks have been created and nurseries maintained in order that forests may grow again. Other agencies that have been useful in reviving forests are the Soil Conservation Service

and the Forest Service, both of which are divisions of The United States Department of Agriculture. Many counties and cities, too, have joined in the campaign to rebuild the forests. Parks and preserves have been set out and are strictly regulated.

Canada, too, has launched a campaign to conserve her forests. The Dominion government and provinces control all the forests and allow wood to be cut only according to regulations. The Canadian Forest Service plants trees, fights fires, and creates new timber areas. See CONSERVATION.

FORGET-ME-NOT. There are almost fifty species of this flower, symbol of friendship and affection. Bright blue, with a yellow eye, the forget-me-not is one flower that is called by the same name in the native language of nearly every country where it grows. The European perennial is the variety grown in most gardens. The unromantic common name for the plant is *scorpion grass*. A bristly burweed of the Pacific coast is called *yellow* forget-me-not.

FORMAL'DEHYDE. The solution known as formaldehyde is important as a preservative and disinfectant and is obtained by removing hydrogen from wood alcohol. It is composed of oxygen, carbon, and hydrogen. By the process of oxidation, the alcohol is converted into formaldehyde, producing a solution of approximately one third formaldehyde and two thirds water.

Solutions of formaldehyde, sometimes called *formalin*, are used in manufacturing certain dyes and some other chemicals. See ALCOHOL; DISINFECTANTS; FUMIGATION.

FORMIC ACID. A colorless, bad-smelling liquid, formic acid is often used as a food preservative. It is found in the common nettle and other plants, in some insects, and in human sweat; it can also be made artificially. The acid received its name from the Latin word *formica*, meaning *ant*, because it was first obtained by placing the bodies of ants in boiling water.

FORMOSA (TAIWAN). Off the southeastern coast of China, in the East China Sea, lies the island of Formosa, a place of majestically beautiful mountains, and of



UPI

SWORDS AND PLOWSHARES

Formosans are used to farming under guard. Taiwan has been conquered many times.

forests and fertile fields that produce much of the world's camphor and tea. Although its population is largely Chinese, the island was controlled by Japan from 1895 until the end of World War II in 1945.

Extending north and south along the western part of Formosa, which is about 225 miles long and 60 to 80 miles wide, is a mountain range which in places attains heights of nearly 14,000 feet. The plain along the western side of the island, facing China, is well suited for agriculture; and there the natives produce great quantities of corn, rice, sugar cane, oranges, and bananas. The camphor trees along the mountain sides produce most of the camphor of the world. On the steep and craggy eastern slopes of the mountains are beautiful forests, in which live most of the 160,000 aborigines on the island.

Formosa exports camphor, tea, rice, sugar, and fruits. Gold, silver, copper, and coal are mined, and there are oil wells and refineries. Hydroelectric plants on the swift-flowing rivers furnish power for industries. Although little larger than the state of Maryland, the island has a population of about 9,500,000. Taipei is the capital.

Occupied by the Spanish and the Dutch

in the early seventeenth century, Formosa soon came under Chinese control and remained so until 1895, when it was ceded to Japan. In 1950 the Nationalist government and army of China, pushed from the continent by Communist forces, took refuge on Formosa. The island was named Formosa, or "Beautiful," by the Portuguese. By the native peoples it has always been known as Taiwan.

FORT. See FORTIFICATION.

FORT DUQUESNE, *du kane'*. Mighty Pittsburgh, America's great steel-manufacturing city, stands today on the site once occupied by Fort Duquesne, built by the French in 1754, and named by them in honor of the governor of New France. Because of its position where the Monongahela and Allegheny rivers united to form the Ohio River, the fort controlled the western wilderness, and the British sought to capture it. One expedition was sent out in 1755, headed by General Braddock, who lost his life. Another was sent out in 1757, but suffered a thorough defeat. Finally, in 1758, the fort fell into the hands of the British and was renamed Fort Pitt. From this name, the settlement that grew up around the fort became Pittsburgh, the city we know today.

FORTH. Facing the chilly winds of the North Sea lies the Firth of Forth, an important inlet of Southeastern Scotland. The river Forth, which empties into it, is formed in Perthshire by the joining of two smaller streams, the Avondu and the Duchray. Following a southeasterly course, the Forth River forms a large part of the boundary between Perth and Sterling counties. As it sweeps round a number of turns in its lower course, it suddenly expands into a magnificent estuary, the Firth of Forth, Britain's finest harbor north of the Humber.

Full fifty miles long and fifteen miles across, the Firth is spanned by a magnificent cantilever railroad bridge at Queensferry. This structure is one of the most remarkable of its kind in the world. There are two shore arms of 680 feet each and two cantilever spans of 1,710 feet each; in-



MEDIEVAL FORTS RELIED ON THICK WALLS AND HIGH RAMPARTS

cluding the steel towers, the total length is 5,330 feet. At high tide the bridge is 150 feet above the water, and the towers are 361 feet high. The bridge was completed in 1889 at a cost of £3,200,000.

FORT HENRY AND FORT DONELSON. The handwriting on the wall for the Confederates in the Civil War was the capture of Fort Henry and Fort Donelson in February, 1862, by the Union army under General U. S. Grant. These two forts, the first situated on the Tennessee River and the other located on the Cumberland River twelve miles away, were built by the Confederates in 1861 to protect the gateway to the South.

But they could not hold out when a river fleet, commanded by Commodore Foote, and Grant's army moved against them. On February 6, Fort Henry fell; and on February 17, Fort Donelson, with 13,000 men and stores of ammunition, was lost. It was when General Simon Buckner, of the Southern forces, proposed a surrender, that Grant issued the famous statement, "No terms except unconditional and immediate surrender can be accepted. I propose immediately to move upon your works."

The capture of the forts not only encouraged the North, which had few other victories that year, but also paved the way for the future campaigns in the South which were to paralyze the Confederacy. See CIVIL WAR IN AMERICA.

FORTIFICATION. When a group of boys make a wall of snow to protect themselves from the snowballs of their "enemies," they have used the principle of fortification, which is the art of strengthening positions against attack. This art has been used by man since the earliest times. Fortifications range from crude walls of brush and mud to elaborately constructed strongholds of steel and concrete. The two purposes of a fortification are to protect against the attacks of the enemy and to hinder his advance as much as possible.

Although fortifications vary greatly as to type and size, they are built to meet the needs of a particular situation and to withstand the type of weapons used by the attackers. Thus in ancient times, primitive people fortified their villages with high, thick hedges, which served very well as a protection against the spears of the enemy. However, when these no longer withstood attack, mounds of mud were used which were later strengthened with stones and trees. Caesar encountered many of these fortifications in his campaigns against the barbarians.

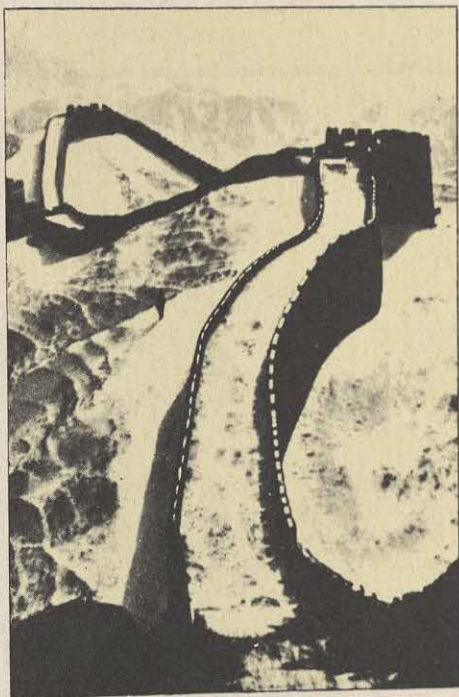
The next step was the wall, made of bricks and concrete; and near the top, platforms were built so that the defenders could see the enemy during the battle. Later, towers were placed at intervals along the walls. Despite these improvements, ways were found by which these fortifications

could be conquered. One method of attack was to place ladders against the walls so that the attackers could reach the top and fight hand to hand with the enemy. Other means of attack were the battering ram, the movable tower, which could be placed beside the wall, and the machine that could throw heavy stones.

After the downfall of Rome, though the wall was still used, it had been much improved. It was made stronger and thicker, circular towers were built, and wide ditches were dug in front of the wall. However, the means of attack were also much improved; siege towers were made larger, and the throwing machines became more effective. Often the enemy undermined the walls by digging away the foundations and burning them. Until feudal times, these methods were constantly used, although they were improved from time to time.

The greatest advancement came with the invention of the castle. Built of thick, heavy stones and masonry, they were placed on hills or cliffs where it would be difficult to reach them. Many of these old castles were impregnable and could be conquered only by starving the defenders into submission. When castles were built on sites that did not have these natural advantages, large ditches were dug around them and filled with water. These were called moats, and were crossed by bridges, which could be drawn up in times of attack. Until the invention of guns and gunpowder, castles of various designs and improvements were the chief means of fortification.

With the development of the rifle and cannon, fortifications were constructed of more durable materials. Masonry walls were built sometimes more than ten feet thick; later, concrete and steel were used. Despite these improvements, it was found that fortresses could not withstand the battering of modern shellfire. In the early months of World War I, many that were thought to be impregnable were laid in ruins in a short time. Their weakness was first demonstrated when the Germans destroyed the great fortresses of Liege.



THE WORLD'S LONGEST FORT

Twisting over North China like a great serpent, this wall shut off northern invaders.

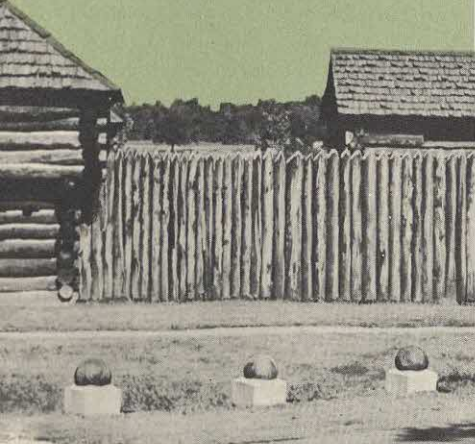
The result was that new types of defenses were rapidly developed. Those most commonly used were trenches, which were dug in a zigzag course about eight feet deep. Many of the trenches included great steel and concrete dugouts, built several feet underground, which afforded protection from most shells and bombs, but acted as a trap when the enemy attacked with heavy poison gas. These were only temporary fortifications, and, in the course of battle, trenches were abandoned and retaken several times in a day.

For more permanent defenses, concrete and steel were used to construct "pill-boxes," which were raised only a few feet above the ground and contained machine-gun nests.

After World War I, stronger and more elaborate fortifications were developed. Profiting by their First World War experience, the French built the Maginot Line, a chain of fortresses along the German bor-

FASHIONS IN FORTIFICATIONS

In pioneer days log stockades and blockhouses were an excellent defense. Modern weapons make traditional fortifications obsolete, so nations depend upon electronic "fences" of radar installations to detect an enemy's approach.



der. Built of steel and reinforced concrete, it had deep underground tunnels, chambers, supply rooms, barracks, kitchens, hospitals, and even elevators for lifting men, weapons, and ammunition to firing positions. Germany had its similar Westwall (first called the Siegfried, then the Limes, Line), facing the Maginot; Finland, its Mannerheim Line; and Czechoslovakia, its "Little Maginot." Despite their seeming strength, not one of these fortifications was able to withstand the enemy guns and bombs that assaulted them during the Russo-Finnish War or World War II. During the latter, deep underground shelters served successfully as air-raid defenses.

Today's fortifications include the huge radar "screens" that various countries have erected to detect enemy bombers, and the defense stations and air bases where anti-aircraft guns, guided missiles, and fighter planes are kept for use against invading aircraft and ships.

FORT KNOX. On the grounds of this military post in Kentucky, some thirty

miles southwest of Louisville, is located the United States Bullion Depository, the storehouse for about half of the nation's monetary gold. Here billions of dollars' worth of the yellow metal is stored in bars weighing about twenty-eight pounds.

The Depository consists of a fortresslike marble building bristling with machine-gun "pillboxes" of concrete and steel and with other protective devices, and of a two-story, underground vault. As impregnable as possible, the vault has thick steel and concrete walls, a bombproof roof, and a twin-locked entrance door weighing some twenty-six tons and equipped with a marvelously sensitive electrical alarm mechanism. The vault is divided into steel-doored compartments, each of which is carefully sealed when full. Completed in 1936, the Depository received its first shipment of gold in January, 1937.

FORT MOULTRIE, *mole'trih.* Here, but for a change in plans by Major Robert Anderson, might have been fired the first gun of the War between the States. In 1860

he had been put in command of the group of small forts in the harbor of Charleston, S. C., one of which was this old fort located on Sullivan's Island. When trouble loomed, however, he moved all of his men in December, 1860, to Fort Sumter, which was better fortified. Fort Moultrie thereby fell into the hands of the Confederates immediately, with the result that the first shot of the war was on Fort Sumter.

Fort Moultrie received its name for the brave defense made by Colonel William Moultrie and his force in 1776 upon an attempted invasion by the British in the Revolutionary War. The fort was built by Colonel Moultrie and was first called Fort Sullivan. In May, 1780, a British force again attacked, and this time succeeded in seizing it. See FORT SUMTER.

FORT PECK. Navigation on the shallow Missouri River the year around, control of floods, and cheap electric power are the purposes for which the great Fort Peck Dam, near Glasgow, Mont., was built. It is the largest earth-fill dam in the world. Approximately 100,000,000 cubic yards of rock

and dirt were dredged from the river-valley bottom and placed in the dam by hydraulic power; this quantity is nearly ten times the amount of concrete which went into the Grand Coulee Dam.

Begun in 1934 and completed in 1940, the dam is 250 feet high, over half a mile wide at its base, and nearly two miles long. A 50-foot-wide highway crosses its top. Its fish-stocked reservoir, a popular recreational center, is one of the world's largest man-made lakes and it is capable of holding more than 6,300 billion gallons of water. See DAM.

FORT SUMTER. On April 12, 1861, the eyes of the world turned to this little fortification at the harbor entrance of Charleston, S. C.; for on that day General Pierre Beauregard, of the Confederate States of America, gave the order to fire on the United States troops lodged in Fort Sumter, thus starting the Civil War.

Two days later, Major Robert Anderson, commanding the Federal troops, surrendered; and Fort Sumter, which had been named for Thomas Sumter, a Revolution-



THE FORUM WAS THE CENTER OF ANCIENT PUBLIC LIFE
Surrounded by magnificent temples and other public buildings, the forum was the scene of public meetings of all kinds, as well as the place where courts of law were held. The most famous of all such forums was the Forum Romanum, the southern corner of which is shown above as it was when ancient Rome was at the height of her glory.

ary War hero, fell into the hands of the South. In February, 1863, the South evacuated it; and on April 14, 1865, when the war was over, Anderson, then a general, raised the same flag over the fort that had been lowered exactly four years before.

The firing on Fort Sumter was significant, not only because it was the first battle of the tragic war that was to cost thousands of lives and prolonged suffering, but also because it crystallized sentiment in the North. Until the South fired, the people of the North mainly were lukewarm concerning a war, but the attack on the flag incensed the North, creating a desire to avenge the seizure and humiliate the South. The event also was instrumental in bringing the important state of Virginia into the Confederacy. See CIVIL WAR IN AMERICA.

FOR'UM. In Roman times a forum was an open place where business was carried on or where courts of law were conducted. Although Rome had a number of such places where people gathered, the most important center was the historic Roman Forum, lying between the Capitoline Hill and the Palatine Hill. It was enclosed by many beautiful structures and was ornamented with statuary. The Senate House, where the Roman Senators carried on the affairs of government, was a conspicuous edifice of the place. And often the emperors spoke from the great Rostrum in the Forum. During the Middle Ages, the Forum was allowed to fall into decay, but its restoration is now being steadily carried on.

In the modern sense, the word *forum* means a discussion of topics of the day, in which everyone is allowed to take part. Usually there is a general address followed by an open discussion in which any interested person may take part. Questions are freely asked and frankly answered. So important have the problems of government become that forum meetings have been presented on radio and television. Thoroughly democratic, the forum brings together men and women of all classes, and with different points of view, who enjoy equal privileges of give and take.

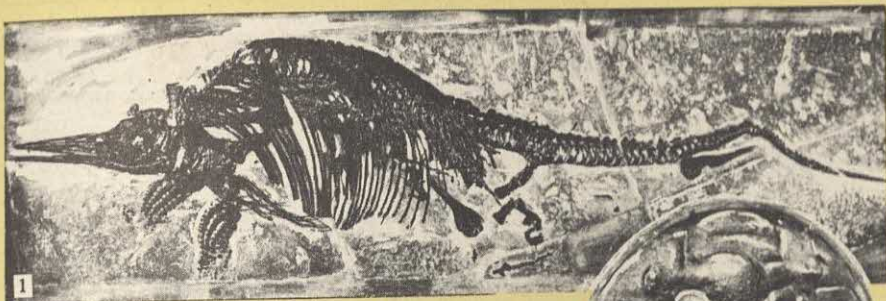
FOS'SIL. Layers of the earth's rock yield revealing fossils, the remains or impressions of animals and plants that lived when the shales, sandstones, or limestones that now contain them were being deposited. Fossils are largely the hard parts, such as shells, bones, and teeth of animals, and woody parts of plants. Some of these ancient life forms are most wonderfully preserved, and many a boy who started to collect them because of their beauty, has grown up and continued his studies, to become a famous scientist because of his knowledge of fossils.

The geologist uses the fossils to determine the age of rocks. Different beds of rock contain different fossils. In the very ancient rocks only relatively simple forms of life remains are found. Successively younger beds, deposited through the hundreds of millions of years of the earth's history, give a wonderful picture of the way life was developed from the simple, early forms, through more complex forms, up to the most highly differentiated forms of the present.

The early fossils show us that at one time the highest forms of animal life were shell-fish and forms such as corals. These were relatively simple. Beds of rock deposited later show more complex shells and corals. In still later beds we find the first animals possessing a backbone—the fish of the *Devonian Period*. In the next period—called *Carboniferous* from its great coal beds—great plants developed in marshes along the seacoast and were buried to form our coal beds of today, which are really fossil plant beds (see COAL).

Later beds contain bones that tell us of the great reptiles and lizard-like animals—the largest animals that ever lived on the earth. Then come beds that contain remains of birds and mammals. Finally comes the age of mankind—which began only a relatively short time ago, in comparison with the hundreds of millions of years that preceded its coming.

By means of fossils the geography of ancient ages can be learned, such as the extent of seas that at various times covered

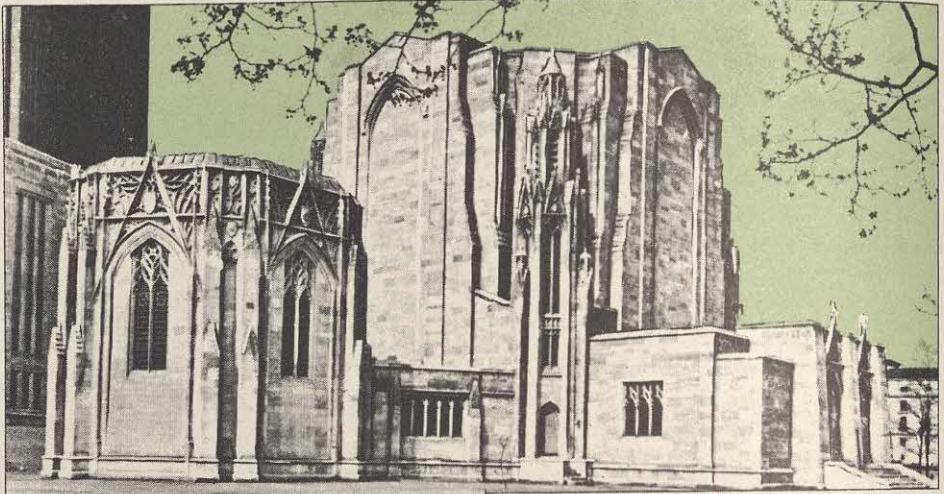


FOSSILS TELL STORIES OF LONG AGO

Buried deep in rock, bones and impressions of many prehistoric creatures have been discovered perfectly preserved. From these fossils, scientists are able to reconstruct the development of the strange life of thousands of years ago.

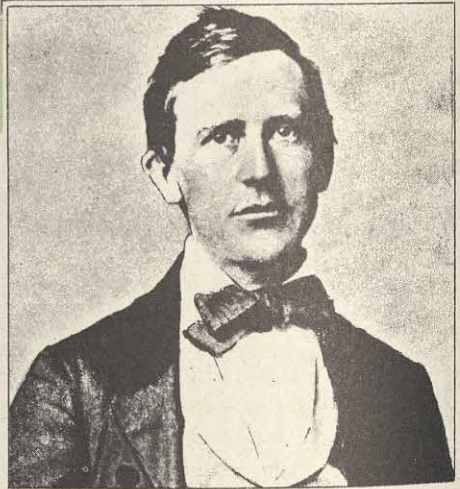
(1) The fossilized remains of an Ichthyosaurus, a weird, beaked reptile which lived in the sea. (2) A trilobite—extinct sea animal. (3) Reconstruction of a giant ground sloth. (4) A fossil group of fish, found in South Africa.





AMERICA'S COUNTRY BARD

The songs of Stephen Collins Foster enjoy perhaps greater popularity than those of any other American. Above, his memorial at Pittsburgh.



large parts of what is now land. Whether the climate of a particular age was warm or cold is indicated by the kinds of fossils found. Fossil fig trees found in Greenland rocks prove that the temperature of the Polar region was once much milder than at present. Fossils of Polar animals found in climates now temperate prove that these climates were once colder than at present.

Valuable deposits of oil and some other minerals are found only in rocks of certain ages. Fossils are thus able to show us in what regions it may be best to hunt for such deposits. See GEOLOGY.

FOSTER, STEPHEN COLLINS (1826-1864). The memory of Stephen Collins Foster will always remain in the hearts of the American people. For his memory has been kept alive by his beautiful songs and melodies, some of which are more popular today than when he wrote them. Although his work is definitely American in spirit, many of his songs are sung by people all over the world, having been translated even into the native tongues of primitive tribes in Africa.

Stephen Foster was born near Pittsburgh, Penna. While still a boy, he became interested in music. Although he had no formal

musical training, he wrote both the words and the music for his songs, and before he died he had composed about 125 pieces of music. Although he wrote beautiful and joyful melodies, his life, for the most part, was very unhappy, and his last years were spent in poverty.

Foster spent all of his life in the North, but he took advantage of every possible occasion to hear Negro music, whether at camp meetings or minstrel shows. So successful was he in capturing the spirit of the Negro, that many of his songs are mistaken for folk songs.

The beautiful melody of *My Old Kentucky Home*, which will outlive most mod-

ern songs, was inspired by one short visit to Kentucky. Another of his outstanding songs is *Oh Susannah*, which was sung by the pioneers as they walked along the Oregon Trail to the West. At one time Foster searched the map to find the name of a river that could be used in a song he was writing. The name he chose was *Suwanee*, a sluggish little Florida stream that Foster never saw. It became the theme for the song *Old Folks at Home*. For this work he received only \$500 from the publishers, although they have since made large profits from its sale.

Negro classics such as *Old Black Joe* and *Uncle Ned* will endure as long as music is sung. Equally famous are *Massa's in de Cold, Cold Ground* and *Come Where My Love Lies Dreaming*.

FOUNDING. At home, on an automobile, or on the street, one comes across hundreds of objects, in all shapes, made of iron, steel, brass, or other metals and alloys. These objects were shaped by the process of founding, and the work was done in a foundry.

As its name implies, cast iron is iron which has been cast, or placed into a mold. The process of founding iron consists of first making a pattern of wood or some other material; if wood is used, the pattern is a little larger than the object, to allow for shrinkage. The pattern is placed in a mold, which is a box in two parts; one part is for the pattern, around which is packed fine sand. The other part of the mold is added, and the process of packing the pattern with sand is completed. As soon as an impression has been made on the sand, the pattern is removed from the mold. Holes are then made in the sand for pouring in the metal. The iron, which has been melted in a furnace, is poured into ladles and then into the mold. When the metal cools, the sand is brushed away, and the molded iron is removed. See FURNACE; IRON; STEEL.

FOUNTAIN. As we drive down the boulevard or through the park, we may come upon a beautiful fountain of water. It may be very simple, with just a stream

of water feeding into a basin; or it may be an elaborate affair of many jets, some going high into the air, others flowing from all directions into a basin.

The name is applied to any number of objects which have running water and a receptacle for catching it, such as a drinking fountain or a natural spring.

Fountains which operate through pipes depend on the pressure applied at the other end. The water, when released, gushes out with a force relative to the pressure.

Fountains were first used for practical rather than ornamental purposes. The Greeks and Romans, however, found them an attractive addition to public parks and palaces. Their fountains were operated on the principle of gravity, which implies that water piped from a higher level to a lower level will rise almost to the height of its source, owing to the pressure of gravity. Pressure for modern fountains is supplied through mechanical pumps.

Outstanding Fountains. Among the most beautiful displays in America are the *Tyler-Davidson Fountain* in Cincinnati, Ohio, and the *Buckingham Memorial Fountain* in Chicago. The latter is the largest illuminated fountain in the world, and at night is beautifully lighted by concealed floodlights of different colors. The famous sculptor, Lorado Taft, created some of the world's finest fountains. His *Spirit of the Great Lakes*, composed of five bronze figures symbolizing the Great Lakes, stands in Grant Park, Chicago; the *Fountain of Time*, also in Chicago, portrays the shrouded figure of Time surveying the march of man. Another handsome fountain is the *Wedding of the Rivers*, at Saint Louis, Mo., which was designed by Carl Milles, the great Swedish sculptor. Others designed by him include the *Fountain of the Tritons*, near Stockholm, Sweden.

Also famous in Europe are the *Fountain of the Innocents*, in Paris; the fountains and cascades at nearby Versailles and Saint Cloud; the *Fontana Maggiore*, at Perugia, Italy; the *Trevi*, in Rome; and the *Alameda Fountain*, at Malaga, Spain.



REYNARD THE FOX

Chief villain of fairy tale and fable, the red fox (left) is really a timorous creature who happens to enjoy a meat diet. He is therefore something of a menace to poultry and small game. Above, the Arctic fox, whose coat is protective coloring in snow.

FOUR-O'CLOCK, or MARVEL-OF-PERU. Some people stoutly maintain that this old-fashioned garden flower really opens exactly on time. It is a fact that its blossoms close early in the morning and open in the late afternoon. The botanical name of the four-o'clock, which originally came from South America, is *Mirabilis*, the Latin word for "admirable."

Four-o'clocks are treated as annuals, but they have quite fleshy roots which may be stored through the winter much as dahlia roots are. The flowers are white, red, pink, yellow, and all sorts of striped combinations, and are very fragrant. The plants are bushy and grow two or three feet tall. They usually do not bloom before late summer or early fall. They are excellent to plant where a low divisional hedge is necessary in the garden.

Sow the seed in March in boxes, and when the plants are large enough, transplant them to small pots or boxes. However, the seed may be sown out of doors. For proper development the plants should stand almost two feet apart when they grow in rich places.

FOURTH OF JULY. See INDEPENDENCE DAY.

FOX. Several distinct species of the fox occur in North America. Among the better-known forms may be mentioned the *red*, *gray*, *white*, and *kit*, or *swift*, foxes. The *cross*, *black*, and *silver* foxes are special color phases which occur in Nature occasionally in the red fox. One or more individuals of these color phases may appear in a litter, the other members of which have the usual tawny or bright-reddish color on the body, and the blackish legs.

Owing to the natural scarcity of animals possessing these peculiarities of color and the exceptionally high prices paid for such pelts in the fur markets, much attention is being devoted to selective breeding of these color phases to produce strains that will breed true. Important progress has been made in this undertaking, and the rearing of black and silver foxes in captivity on fox farms has grown to be a thriving and valuable industry in Canada and Northern United States (see FUR AND FUR TRADE).

A similar color phase known as the *blue* fox occurs among the Arctic, or white,

foxes. The pelts of these animals are also highly prized, and much has been done in establishing these blue strains on fox farms in Alaska and in making them the dominant strains on the Pribilof Islands in Bering Sea and many islands of the Aleutian chain.

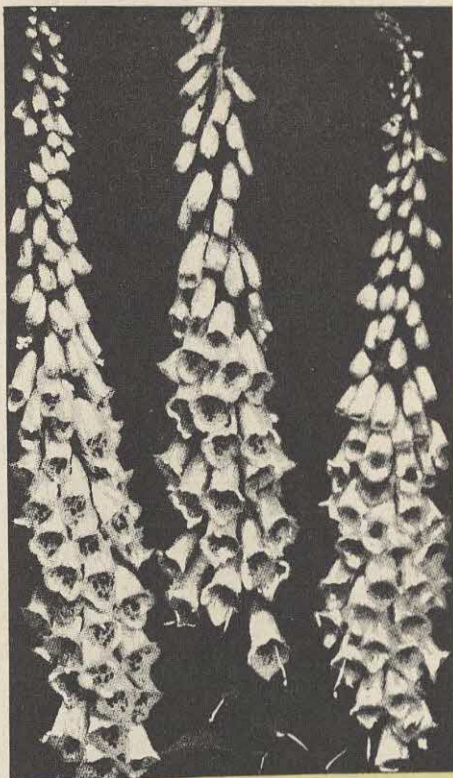
One or more species of fox occurs in practically all the territory from Alaska and extreme Northern Canada to Southern United States, except the regions east of the Mississippi River, bordering on the Gulf of Mexico. The alertness and keen intelligence displayed by the red fox in capturing its prey and in eluding its enemies are well known, and it deserves the place which it holds in the traditions and literature of the world.

Foxes generally mate for life, and according to the species produce their young in dens excavated in banks or hillsides, in ledges of rocks, or in hollow trees. They feed chiefly on rabbits, mice, and birds, occasionally raiding the farmers' poultry. Individuals often become seriously destructive, though the feeding habits of foxes are generally beneficial.

FOX. An Algonquian tribe once important in the middle-western part of the United States, the Fox Indians are now scattered in Oklahoma, Iowa, Kansas, and Nebraska. They called themselves the *Musk-wakuiik*, or *Red Earth People*; but the French gave them the name *Renard*, meaning *fox*. About 1760 they united with the Sauk. Their ranks have been so greatly reduced that they now number only about 900.

FOX, CHARLES JAMES (1749-1806). Friend of the American colonies, Charles James Fox was one of those members of George III's Parliament who favored the cause of the colonists during the American Revolution. He stubbornly opposed the sending of an army to enforce the unjust laws saddled upon the Americans and advocated giving the colonists a voice in their government.

A talented orator and politician, Fox rose rapidly in government circles after he en-



FOXGLOVE'S BELL-LIKE PETALS

tered Parliament in 1768. He associated himself with Edmund Burke and bitterly opposed William Pitt, who were among the few men to outrank him in oratory. He drew considerable criticism because of his admiration for Napoleon.

FOX'GLOVE. Long ago, each family garden had a small plot of various herbs and roots, among which was foxglove. Teas which were thought to have healing properties were brewed from these plants. It is now known that the leaves and stems of foxglove contain *digitalis*, a bitter drug extensively used by physicians to stimulate the action of the heart.

Clustered on tall spikes, the varicolored flowers are thimble-shaped; thus the common name and its many variations, such as *folk's glove* and *fairy's glove*. Foxglove, a native of Europe, is grown in America as a garden flower.

FOXHOUND. With a loud baying, the foxhound darts across field and wood, followed by eager hunters of the fox. This dog has a keen sense of smell and is easily trained as a hunting dog. Large, straight legs give him remarkable endurance.

A cross between the staghound or the bloodhound and the greyhound, this dog has short, smooth, white hair, spotted with black or brown. The ears are wide and thin. The dog is about twenty inches high.

FOX TERRIER. One of the most beloved of household pets is the dog known as the fox terrier. Some terriers are smooth-coated; others have wiry, rough hair.

Because of its small but powerful body, the terrier was originally used to drive foxes from their lairs. The dog is similar to the foxhound in color—white with black or tan markings. It has small, pointed ears and a long, narrow head with powerful jaws. Its average weight is twenty pounds, and average lifetime fifteen years.

FRACTION. See ARITHMETIC.

FRANC. In France the monetary unit is the coin called a franc. Some other countries, including Belgium and Switzerland, have also adopted the same unit. Used in France since 1795, the franc was for many



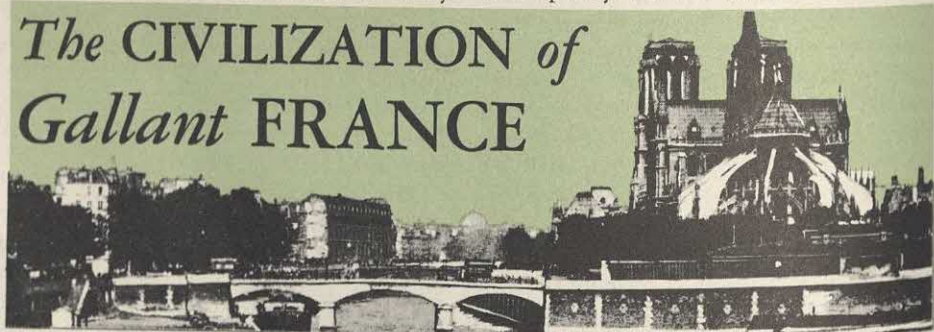
A FRISKY PET

The energetic fox terrier is ever full of fun.

years valued at 19.3 cents of American money. World War I greatly decreased its value, and in 1928 it was stabilized at 3.9 cents. Thereafter it varied considerably according to political conditions, especially in the period of World War II.

Under the French coinage system, the franc is divided into ten *decimes* and 100 *centimes*. The decime roughly corresponds to the American dime, being one tenth of the standard unit; the centime corresponds to the penny. See COINS AND COINAGE.

The CIVILIZATION of *Gallant* FRANCE



FRANCE. Romantic France, one of the leading art and style centers of the civilized world, is distinguished for love of beauty. From France comes much of the finest literature, most appealing art and sculpture, smartest of feminine apparel, and most desired luxuries of the world. And to France belongs the unique distinction of being the first great power of continental Europe to

establish a lasting democracy. Another claim to glory is the story of how the nation, though saddled with debt, robbed of resources, and sacked by invading enemies, successfully fought to maintain her standing as a world power.

Location and Area. Lying in about the same latitude as Maine, France is the most westerly nation in continental Europe, with

the exception of Spain and Portugal. With about 2,000 miles of coast line, the nation is supplied with a number of good harbors along the Bay of Biscay, the Mediterranean, and the English Channel. Bounded by Belgium and Luxemburg on the northeast, by Germany, Switzerland, and Italy on the east, by the Mediterranean and Spain on the south, by the Bay of Biscay and the English Channel on the west, France holds the most enviable commercial position on the continent. Her land boundaries are chiefly natural, for between France and the nations on the east rise several mountain ranges—the Alps, the Juras, and the Vosges; the lofty Pyrenees form the Franco-Spanish border.

Previous to World War I, France was the fourth nation in size on the continent, ranking after Russia, Austria-Hungary, and Germany. Today, its area of 212,659 square miles is surpassed in Europe only by Russia. This area includes the island of Corsica, with its 3,367 square miles. The increase in area came about in this way: France, one of the victorious nations in World War I, asked for a return of the provinces of Alsace and Lorraine, lost to Germany in the Franco-German War of 1871. The Allies turned the territories back to the French. The Saar Basin, an area of rich German coal fields, was given to France under League of Nations control to compensate the French for loss of coal during the war. The Saar became German again in 1935. After World War II, its people voted for union with France in 1947, but in 1955 for union with Germany. The Saar became part of the Republic of Germany.

The Land. The greater part of France is a low, flat territory, but in the south and southeast are rugged mountains. Between France and Spain, the Pyrenees thrust their peaks skyward to a height of 10,500 feet, the whole range averaging well over 9,000 feet. The beautiful natural boundaries on the east are dominated by the Alps, where Mont Blanc, noted for its beauty, rises to a height of 15,781 feet. Running north and south, parallel to the Alps and Juras, are the Cevennes, a natural divide between the



FRENCH EMPEROR—A.D. 800
Charlemagne, greatest of French rulers, carved
an empire in medieval Europe.

Rhine and Rhone rivers and those which empty into the Bay of Biscay and the English Channel. Other medium-height mountains of volcanic origin breaking the Massif Central, or South-Central plateau, include the Auvergnès.

Rivers. Though France has over 200 navigable streams, there are only five great rivers. The beautiful, busy, border-forming Rhine gives access to the North Sea. The Garonne, rising in southeastern France, follows a northwesterly course to the Bay of Biscay; there it empties into a large inlet upon which is located the city of Bordeaux. The Rhone originates far up in the Alpine ranges of Switzerland. The river flows off to the southwest, turning its course due south near Mâcon and continuing past

Lyons to the Mediterranean, where it empties into the sea near Marseilles.

The Seine rises in Eastern France and wends its way in a northwest direction past Paris and on to Havre, where it empties into the English Channel. The Loire, starting as a tiny stream in the Cevennes Mountains, flows northwest to Orleans, then suddenly veers to the west and empties into the Bay of Biscay at Nantes. The lakes of France are small and unimportant.

A Country of Varied Climate. France has a delightful, temperate climate, especially in the northern plains area. The Gulf Stream keeps the temperature always moderate in spite of the northern latitude. As one travels south into the more mountainous areas, the air becomes cooler; and, in the region of the Alps, real winter is encountered. Along the Mediterranean, sheltered by the protecting mountains to the north, the land is a paradise to vacationers. For there the climate is always so mild that oranges, olives, grapes, and other semi-tropical plants and fruits are cultivated. Warm winds blowing in from the Mediterranean aid in keeping the climate always delightful. France has an average rainfall of about thirty inches, although in the mountainous regions to the south and southeast it exceeds forty inches.

Natural Resources. Besides the rich coal sections of Alsace and Lorraine, France has two other valuable coal deposits. One, at Valenciennes, lies to the northeast near the Belgian border. The other, at Saint Etienne in the southeast, furnishes coal for Lyon and the surrounding manufacturing areas. The northeastern coal mines were captured in World War I. Many of them were wrecked by the retreating Germans in 1918, and months of work were required to put them into operation again. Production was disrupted again during World War II, when, from 1940 to 1945, the Germans controlled all French mineral resources. France normally produces about 50,000,000 tons yearly; this amount is so far short of domestic needs that coal must be imported from England and Belgium.

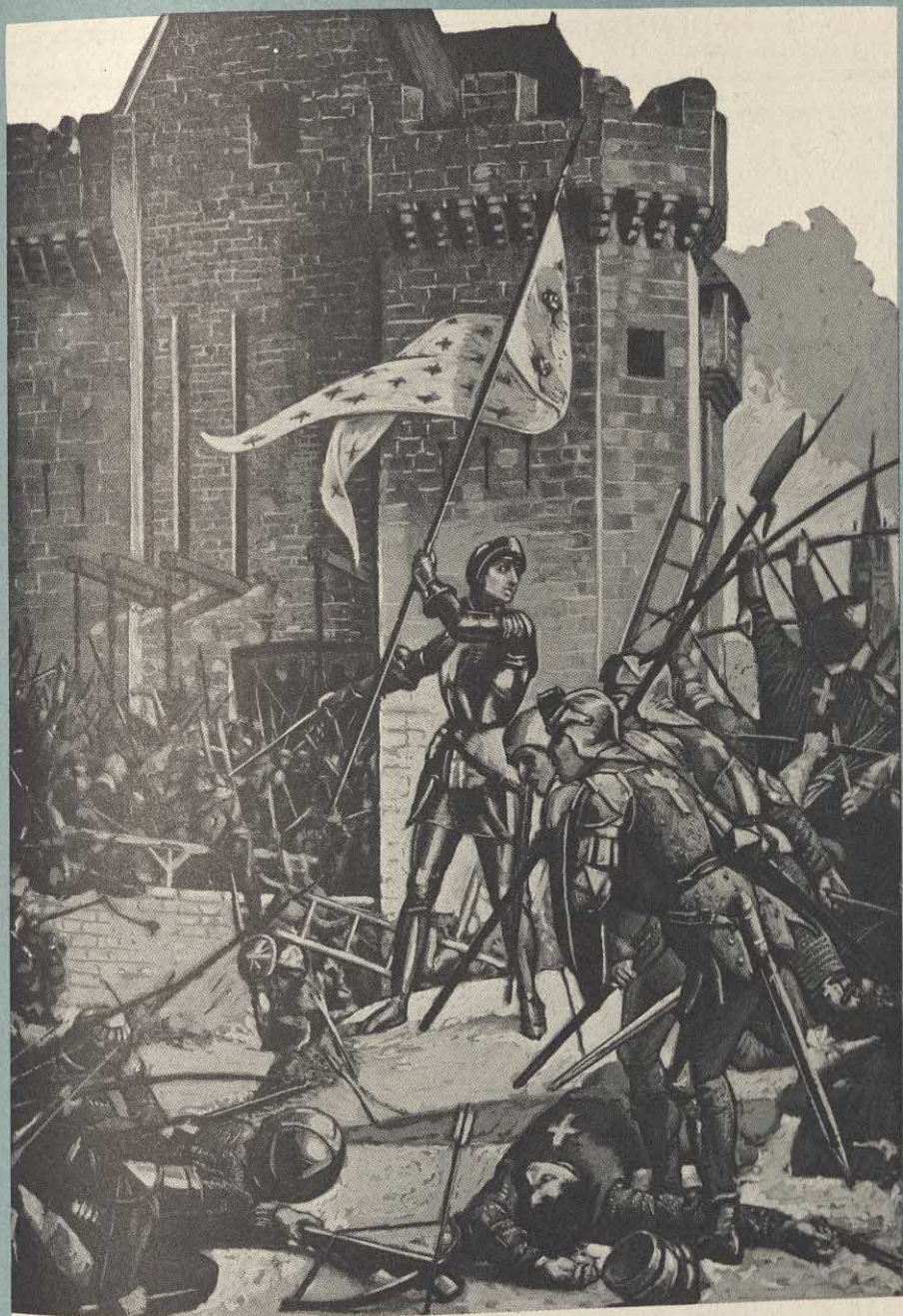
France, like England, is fortunate in having iron deposits in the midst of her coal fields; but the iron supply, too, falls short of requirements, and large quantities must be imported. Copper, lead, zinc, and manganese are found in limited amounts, and marble is quarried in the Alps and Pyrenees. Granite, slate, and building stone are found over scattered areas. Salt is obtained in large quantities from salt mines and from lagoons and marshes along the coast.

Fisheries. In France, fishing has long been an important industry. Along the Bay of Biscay sardines are found in vast quantities; in the English Channel and the North Sea, salmon, mackerel, herring, and turbot are caught; tunnies and anchovies are found on the shores of the Mediterranean; and oysters are extensively raised in the Arcachon Basin west of Bordeaux. But fishing is not confined to the shores of France, for many French fishermen go to the Grand Banks of Newfoundland and to Iceland for cod fishing.

Farming in France. By far the dominant occupation of France is agriculture, for fully nine tenths of the soil is productive. About half the country is now under intensive cultivation. Next to Russia, France is the leading wheat producer of Europe. Oats, rye, barley, mixed corn, potatoes, hemp, flax, beets, buckwheat, and rape are also raised in abundance. Of importance also are the raising of tobacco (monopolized by the government) and the cultivation of sugar beets.

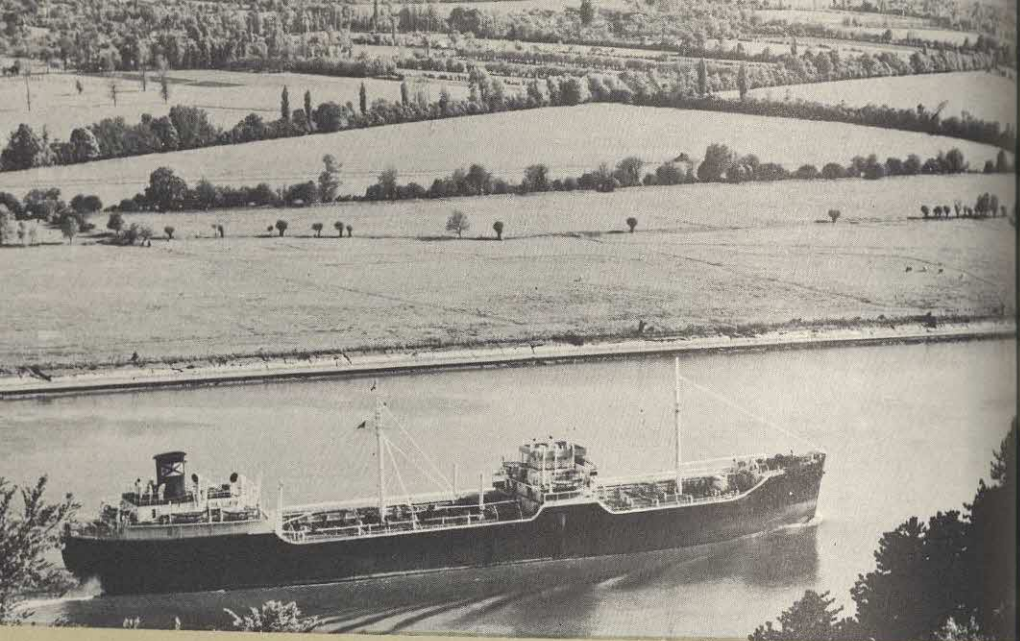
In the northern and central parts of France, apples and chestnuts are important foods, and along the Mediterranean, grapes are the leading crop. The French are noted for their fine grape wines, and in good years fully half the world's wine supply is produced in France. Other crops of Southern France are oranges, citrons, figs, peaches, pears, plums, and olives. In Southeastern France the mulberry tree is cultivated, its leaves serving as food for the silkworms which are extensively raised as the basis of the country's great silk industry (see *SILK*).

The pasture lands of France are not good, and cattle raising is, therefore, not an im-



THE HEROINE OF ORLEANS—FRANCE'S SAINT JOAN

The glorious yet grimly tragic career of Joan of Arc makes one of history's most stirring stories. She was a French country girl who had a vision in which God instructed her to save her country and her people. Promptly she donned full knightly armor, took her place at the head of the army, and marched victoriously to the rescue of the city of Orleans, besieged by the English. But then the innocent girl was seized and burned at the stake for witchcraft.



Standard Oil Co. (N. J.)

INLAND WATERWAYS AID FRENCH INDUSTRY

Here, a tanker moves through the French countryside, along the Seine River.

portant branch of farming. Sheep, hogs, goats, horses, mules, chickens, turkeys, and geese also are raised, and wool, meats, skins for making fine leathers, eggs, butter, and milk for delicious cheeses are important animal products.

Usually under twenty-five acres in size, most French farms are owned by the peasants who till them. The skilled, hard-working, thrifty farmers cultivate their small holdings so intensively that practically every foot of France's farmable soil is kept productive. The diversity of the crops helps them to supply most of the country's food needs as well as some food exports.

Industries. France's gifted craftsmen are noted for the quality of their products. Among their choice wares for foreign markets are superior wines, liqueurs, and brandies; *pâté de foie gras* (goose-liver paste) and cheeses; fine textiles; and high-fashion wearing apparel. French perfumes, jewelry, cosmetics, furniture, tapestries, glass-ware, china, pottery, and art objects are also famous.

In addition, France has busy shipyards, ports, oil refineries, and iron and steel mills. Its many manufactures also include auto-

mobiles, trucks, locomotives, chemicals, munitions, precision instruments, optical goods, glass, paper, articles of rubber, and beet sugar. Domestic and imported coal and hydroelectric power run the nation's industrial plants.

Tourism. Few countries have a larger tourist trade than has La Belle France (beautiful France), whose natural and man-made attractions are legion. Only a few of these are the country's varied, picturesque scenery, its many fine museums, spas, and resorts, its charming small towns, its great cities, with their world-famous shops, its sports centers, excellent foods and wines, artistic architecture, and many points of historic interest.

Transportation. Many of France's excellent transportation facilities had to be rebuilt and reorganized after World War II. Before long, however, the nation's luxury liners and heavily laden merchant vessels were again putting in at the world's ports, and its international airports were once more beehives of activity. In addition, over 6,000 miles of navigable rivers and joining canals were again being used for shipping and the extensive networks of railways,

highways, and domestic airlines were being improved. In 1938 France's independent railways were merged to form a national system in which the state keeps a controlling interest. Soon after World War II, its airlines were nationalized, as were its banks, coal mines, public utilities, and certain industries.

Trade. Much of France's trade is with nations which were formerly part of its overseas possessions, but commerce with other nations is also important. In general, France imports raw materials and exports manufactured goods.

Cities. Paris, one of the world's largest and finest cities, is the nation's capital and its cultural, industrial, financial, and transportation hub. Other important cities include Marseilles, Lyons, Bordeaux, Nice, Nantes, Lille, Saint-Etienne, Toulouse, Strasbourg, and Toulon.

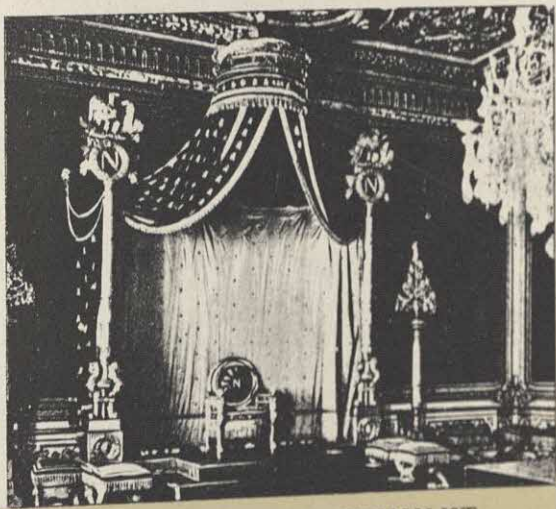
People. The people of France are an intermixture of various peoples. Those in the North usually are tall, fair, and obviously of Teutonic origin. In the South most of the people are stocky, dark, and typically Latin. Through intermarriage,

these and other groups have merged to create a stock that can be called truly French, with the stolidity, devotion to duty, and industry of the Teutons combined with the liveliness, quick temper, love of beauty, and artistic abilities of the Latins. The Bretons of Brittany and the Basques of the Pyrenees region are separate groups, which cling to their ancient customs and speak their own tongues. Few countries have produced more great writers, artists, scholars, and scientists than has France.

In addition to the languages mentioned, Flemish is spoken near the Belgian border, some German in the northeast, and some Italian in the southeast. Nevertheless, French is the prevailing tongue of the country. See FRENCH LANGUAGE.

The population of France is about 44,500,000. After remaining almost stationary between World Wars I and II, it began to increase again after World War II.

Education. France is noted for its educational facilities. A Minister of National Education, aided by various groups, sets the standards for the country's excellent private schools and all public education



FRENCH EMPEROR—A. D. 1809

THE GREATEST IMPERIALIST

Napoleon Bonaparte's was possibly the most spectacular military career in European history. At one time, through a series of relentless campaigns of conquest, he was absolute monarch of more than half of Europe, holding forth in the Castle of Fontainebleau (right). His was a military dictatorship, however, depending upon his success with the army. He met his first defeat at the hands of the Russians—was finally crushed at Waterloo.

is under the supervision of the national government. Schools are free, and education is compulsory between the ages of six and thirteen. Boys and girls attend separate classes. Corresponding to the high schools of the United States are the *lycées*, or state colleges. In addition, private schools and communal colleges are maintained, the latter being supported by the various communes.

Girls wishing higher education usually attend convent schools; but the boys attend secular schools from which they must have certificates before they can qualify for professional or government positions. Beyond the high schools, a number of special schools, private tutors, and universities offer higher education. The finest university, that at Paris, has an average student body of about 30,000. France is divided into seventeen districts, each of them subdivided for the purpose of school supervision.

Government and Religion. France is a republic with a government somewhat similar to that of the United States. The President is not elected by the people but by the two houses of the national legislative body. His term is seven years, and he may be re-elected. The legislature is composed of the Chamber of Deputies and the Senate; members of the Chamber serve four years, Senators nine years. The President appoints a Premier, whose Ministry heads the executive branch of the government and is responsible to the national legislature.

France is divided into ninety departments, corresponding to states, each governed by a prefect appointed by the President and assisted by an elected council. Each department is divided into *arrondissements*, *arrondissements* into cantons, and the cantons into communes. Over each commune preside a mayor appointed by the government and a council elected by the people. From the mayor of the commune up through the greater subdivisions, every officer is directly responsible to the one above him and, consequently, to the President.

The highest court of France is the Court of Cassation at Paris, presided over by a

president, three presidents of sections, and forty-five judges. Under this court are the twenty-seven appeal courts, each with jurisdiction over several departments. There are also numerous justice courts of the cantons and communes.

The Roman Catholic religion is professed by far the greatest number in France. Until 1906 there was a close relationship between the government and the Church, but in that year Church and state were separated. Complete religious freedom is guaranteed to all by the French government.

French Possessions. Young nations now occupy the greater part of what was France's empire in Indo-China and Africa. France still retains Algeria and a few scattered possessions in America and Oceania. Many of the new nations retain economic ties with France in the French Community of Nations. See *AFRICA, Political Divisions*; *ASIA, Political Divisions*; *FRENCH COMMUNITY*; *FRENCH UNION*.

The Story of France. Ancient Celtic peoples inhabited France long before the birth of Christ. Before the time of Caesar, the Romans had conquered the southern part of Gaul, as France was then called; but it was not until Caesar led his legions into the country from 57 to 52 B. C. that the conquest of Gaul was complete.

Under Roman domination, the country advanced rapidly, numerous towns sprang up, and civilization flourished. During the latter part of the Roman rule, the German tribes of the Visigoths, Burgundians, and Franks began to settle in Gaul. Toward the close of the fifth century, the Franks, under Clovis, drove out the Romans and took the land for themselves. Clovis set himself up as ruler, not only of much of Gaul, but of large areas east of the Rhine as well. It is from the Franks that France gets its name. The dynasty, or line of rulers, established by Clovis is known as the Merovingian dynasty.

Clovis died in 511, leaving his kingdom to be divided among his four sons. The reign of these Merovingian kings was marked by struggles for supremacy between the king-

Right, President Charles de Gaulle. De Gaulle, a lifetime soldier and President of the Fifth French Republic, won his great popularity by calling for all-out resistance when France fell to the Germans in 1940. After the war, when French governments had trouble remaining in power, De Gaulle suggested creating a strong Presidency. The French people did this by a new constitution and elected De Gaulle President. Below, "Grass Roots" of French Democracy. The average Frenchman loves politics. Here in the *Conseil Municipal*, similar to an American board of aldermen, French town councilors joke in the middle of a debate on town issues.

French Embassy Press & Information Division



Such Men As These Guide France

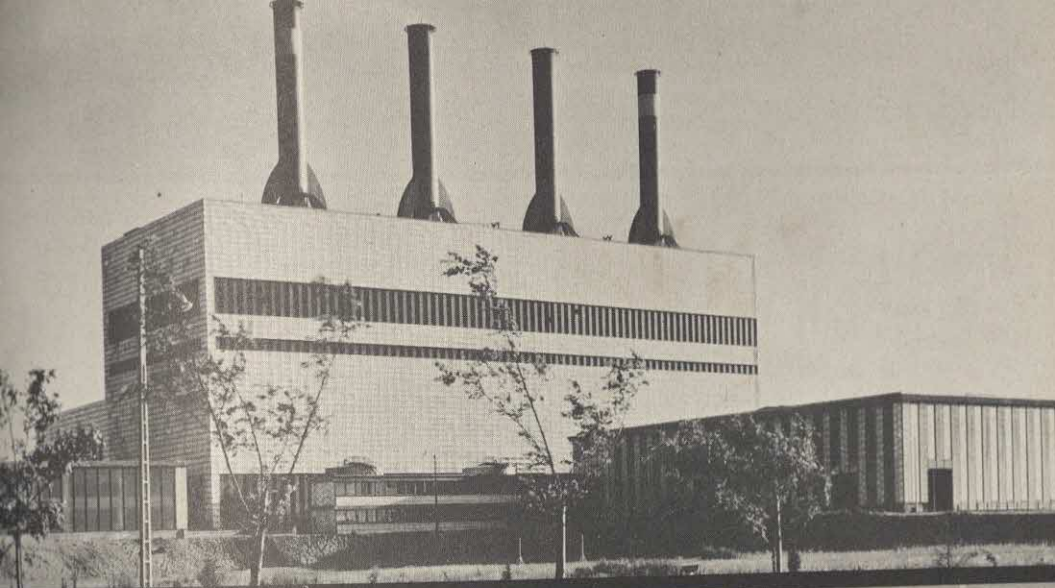




MOST MAJESTIC OF FRENCH CATHEDRALS

Famed for its ugly gargoyles, Notre Dame Cathedral displays fine Gothic sculptures in its doorways. The cathedral was begun in 1163.

Fritz Henle



FRANCE IS MODERN. USES MUCH ELECTRICITY

This handsome building (above) houses a steam-powered generating plant that supplies electric service to the Nantes-Chevre district. As France has a shortage of coal, which is the fuel used in steam plants, water power resources are developed wherever possible. Many of the country's hydroelectric plants are located in the Alpine departments, where the rivers run swiftly. At right, brilliant electric lights, mounted on tall poles, illuminate a six-lane highway on the Seine and Oise route, near Paris.

French Embassy Press & Information Division



doms of Neustria and Austrasia, the two most important divisions of the empire. Pippin, mayor of the palace of the king of Austrasia, eventually conquered Neustria, bringing all France under one rule. Although not kings in name, both Pippin and his son, Charles Martel, succeeded in holding the balance of power. The mayor of the palace to the last Merovingian king was Pippin the Short; he was elevated to the throne in 751 as the first of the Carolingian kings.

Pepin's son, Charles the Great, or Charlemagne, succeeded him and proved to be one of the greatest rulers ever to reign over this territory. Strictly speaking, Charlemagne was a German emperor, for there was, as

yet, no kingdom of France. Under the reign of Charlemagne the empire was extended from the coast of Illyria to the Bay of Biscay and from the Mediterranean almost to the Baltic Sea. Under Louis the Pious, Charlemagne's son, the power of the empire crumbled, and the land was divided among the sons of Louis by the Treaty of Verdun in 843. Of this vast area, Charles the Bald received the portion that is now France and Southern Belgium.

Not many years after the death of Charles the Bald, Charles the Fat, king of Germany, became king of France. But he was able to hold his newly acquired lands only three years before the throne was usurped by Odo, Count of Paris. Odo held sway but a

short time, however, before Charles III became king. Under him France was weakened by division into numerous fiefs, which were practically independent. Moreover, the Normans raided the northern coast so persistently that in 911 Charles was forced to pacify them with a large grant of land, later called Normandy.

During the reign of Louis V, the practice of granting fiefs was continued until many of the vassals had more power than the king had. After the death of Louis, in 987, Hugh Capet, son of the most powerful vassal, became king, thus founding the Capetian dynasty. He brought with him the fiefs of Paris and Orleans, which, added to the small region already actually under the crown, created a somewhat stronger kingdom than had existed under the Carolingian kings.

Under the Capetian rulers, efforts were made to regain the privileges surrendered to the vassals. It was not until Louis the Fat came to the throne in 1108, however, that these efforts began to be successful, and then only because the towns aligned themselves with Louis against the lords, who were already weakened by the Crusades.

A long line of Capetian rulers, all partially successful in regaining the former domains, was brought to a halt by the death of Charles IV in 1328. The rise of Philip, of the House of Valois, followed. But his reign and those of his successors were stormy indeed, for France was almost continually at war with England, whose king claimed the French throne. The Hundred Years' War began in 1337 and lasted intermittently through successive reigns until 1453.

During the reign of Charles VII, all French territory except Calais was regained from the English. It was during his reign, too, that Joan of Arc saved France from the English at Orleans in 1429. Under Louis XI, who ruled from 1461 to 1483, the government became an absolute monarchy, following the complete subjugation of the nobility. His son, Charles VIII, added even more strength to the monarchy by marrying Anne of Brittany, thus bringing Brit-

tany under the crown. During his reign occurred the first invasion of Italy by France.

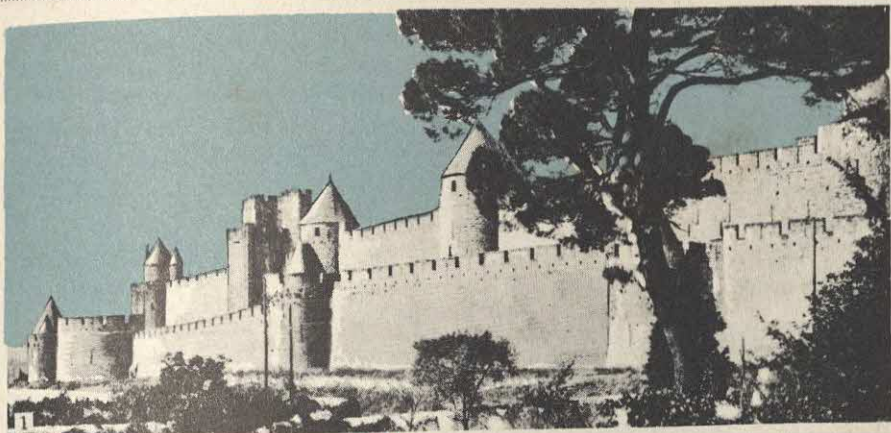
Charles was succeeded in 1498 by Louis XII of the House of Valois-Orleans; and he, by Francis I of the House of Valois-Angoulême, who came to the throne in 1515. Francis continued the conquest of Italy and was plunged into war with Austria under the German king Charles V over possession of Milan; but he was badly defeated. Francis died in 1547 and was succeeded by Henry II, who continued the struggle with Austria. At this time began the famed persecution of the French Huguenots.

Succeeding Henry II was Francis II, his son and the husband of Mary, Queen of Scots. He reigned about a year before he was succeeded first by Charles IX and then by Henry III. It was during the reign of Charles IX that the bitter fight between the Catholics and Huguenots came to a climax with the slaughter of the Huguenots in the Massacre of Saint Bartholemew (see CATHARINE DE' MEDICI).

Peace reigned again between these warring religious factions when Henry IV of Navarre came to the throne in 1589. Although he turned against his previous friends and became a Catholic, he brought about religious freedom in France by the Edict of Nantes, in 1598. Henry's son, Louis XIII, who became king in 1610, showed signs of being a weak ruler until a guiding hand was given by his prime minister, Cardinal Richelieu. Under their combined efforts, the oppression of the Huguenots and the warfare against the Austrians continued, the result being the complete removal of the Huguenots from French politics and the winning of Alsace, Metz, Toul, and Verdun from Germany.

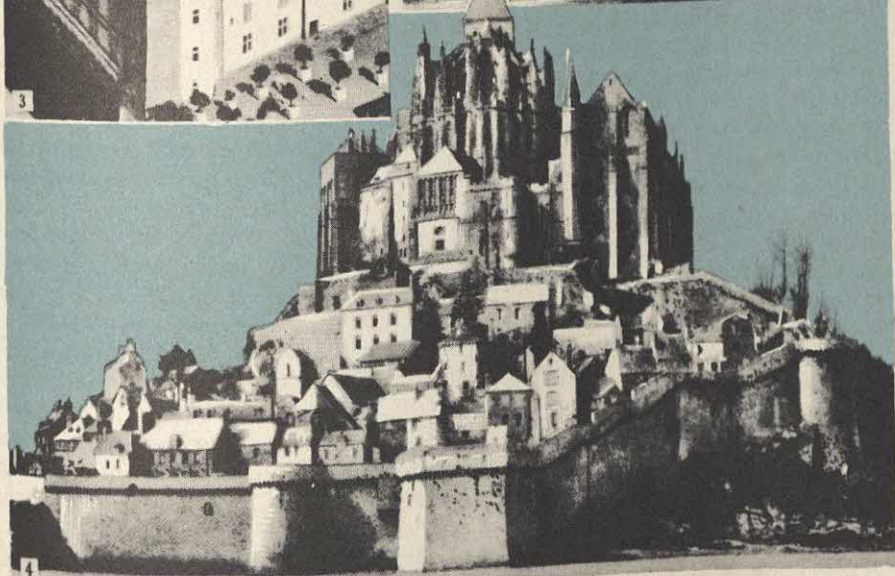
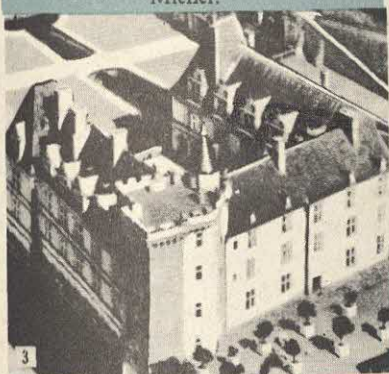
Upon the death of Louis XIII in 1643, his son, Louis XIV, succeeded to the throne. Noted for his extravagance, Louis XIV piled up an alarming national debt and seriously crippled industry. Matters went from bad to worse under Louis XV, and the country was led into foolish wars.

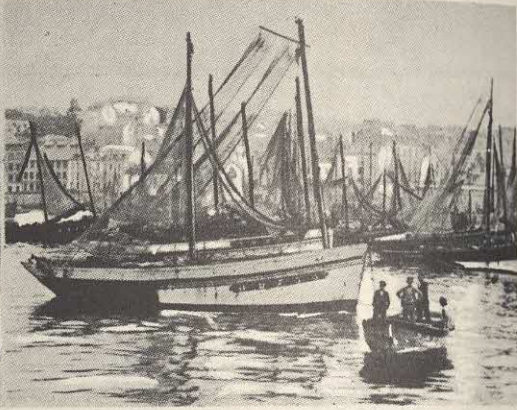
Louis XVI, a weak but well-meaning



MAGNIFICENT FRANCE

The kings and dukes of regal France built many a splendid chateau and castle; surrounded all with beautiful gardens and estates. (1) The old fortress of Carcassonne. (2) The Chateau de Josselin in Brittany. (3) A corner of the huge Chateau de Villandry. (4) France's enchanted isle—Mont Saint Michel.





HOME OF HARDY BRETON SEAMEN

Brittany, in the northwest corner of France, has a charm all its own. Left, a typical oldster of the waterfront. Above, ancient homes in a harbor town. Right, fishing ships at home in the harbor. Fleets of these little craft do a huge business fishing in the Atlantic and the Mediterranean.

monarch, became king in 1774. Under the influence of the court, he continued to levy heavy taxation, all of which was directed at the peasant class. Several capable men attempted to straighten out the finances of the country and failed. Finally, Louis called a meeting of the States-General in 1789 in the vain hope of working out a solution. This body had not met since 1614, and met at this time only because the king found himself involved in a hopeless situation.

Little was accomplished, and the French Revolution broke out, a bloody revolt in which the downtrodden peasantry vented their full fury upon the nobility. After ten years, the Revolution ended with the appointment of Napoleon as first consul of the new government. Napoleon, for the following sixteen years, completely dominated the history of Europe.

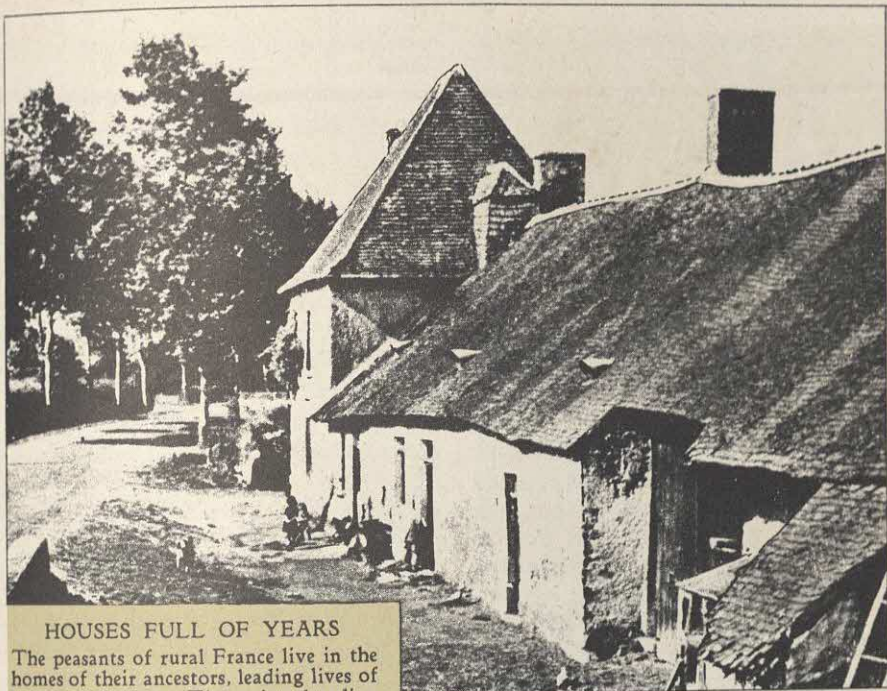
In 1814 Napoleon abdicated and Louis XVIII came to the throne. At first, he was supported by the common people, but soon the returning aristocrats again dominated the nation. Charles X succeeded Louis in 1824 and the peasantry again became a downtrodden people. Finally, in 1830, the people revolted and overthrew Charles, Louis Philippe then ascending the throne. In 1848 his unpopular reign came to a bitter

end with another revolution, and a republic was proclaimed with Louis Napoleon, nephew of Bonaparte, elected as President for four years. By the end of the third year, he had his term extended for an added ten years, and in 1852 was declared Emperor Napoleon III.

In 1870 the Franco-German War broke out as the result of a quarrel between France and Germany over the crown of Spain. The war brought disaster to France, and Paris fell into the hands of the enemy in the following year. Moreover, France suffered the loss of Alsace and Lorraine, valuable coal areas. As a result of the war, the Third French Republic came into being in 1871, the present Constitution being adopted in 1875. The first President was Louis Thiers, who served from 1871 to 1873. Sadi Carnot, fourth President, was assassinated in 1894 in a vain attempt to restore the monarchy; but that and other political disturbances failed to break the unity of the nation.

In 1914 France was plunged into gigantic World War I against Germany and Austria-Hungary, a struggle that lasted four years and cost the nation billions of dollars and millions of lives (see WORLD WAR I).

After the defeat of Germany and Austria-



HOUSES FULL OF YEARS

The peasants of rural France live in the homes of their ancestors, leading lives of quiet satisfaction. The noisy, bustling city of progress and destiny has not marred the village's quaintness. Above, home and barn in one—a French farmhouse. Below, a thatch-roofed peasant's cottage in picturesque Normandy.



Hungary in 1918, France had many financial and political problems to face. France joined Great Britain in World War II in 1939. In 1940, Germany occupied more than half of France and dominated the Vichy government in the southern half. French patriots set up tremendous underground resistance to aid the Allies. In September, 1944, after the Normandy landing in May, General Charles de Gaulle, leader of the "Free French," formed a government in Paris.

France's parliamentary government did not function well in postwar France. Moreover, her territories wanted more rights. The constitution setting up the Fourth Republic of France in 1946 did not help France toward stable government, but did set up the French Union by which French territories received more recognition. France lost Indo-China in 1954 after an eight-year war, and Algeria revolted. In 1958, General De Gaulle again became the French leader. The new constitution, which founded the Fifth Republic, gave the President many strong powers to cope with conditions in France, and set up the French Community in which overseas territories could become nations.

Consult, also, the following titles:

CITIES AND TOWNS

Avignon	Fontainebleau
Calais	Paris
Cr�cy	Versailles

GEOGRAPHY

Alps	Normandy
Alsace-Lorraine	Pyrenees
Brittany	Rhine
Loire	Rhone
Marne River	Seine
Mont Blanc	Vosges Mountains

OVERSEAS AREAS

Algeria	Madagascar
Cameroon	Marquesas Islands
Colonies and	Martinique
Colonization	Morocco
Corsica	New Caledonia
French Equatorial	New Hebrides
Africa	R�union
French Guiana	Saint Pierre and
French Indo-China	Miquelon
French West Africa	Senegal
Guadeloupe	Society Islands

Somaliland
Tahiti

Tunisia

HISTORY AND GOVERNMENT

Aix-la-Chapelle	Merovingians
Austerlitz	Nantes, Edict of
Bonaparte	Normans
Bourbon	Orleans
Capetian Dynasty	Paris, Treaties of
Carolingians	Plantagenet
Celts	Quebec, Battle of
Ch�lons, Battle of	Reformation, The
Code Napoleon	Renaissance
Commune	Sedan, Battle of
Commune of Paris	Seven Years' War
Continental System	States-General
Crimean War	Succession Wars
Crusades	Thirty Years' War
Franco-German War	Triple Entente
French and	Utrecht, Treaty of
Indian Wars	Valois
French Revolution	Versailles, Treaty of
Gaul	Vienna, Congress of
Guise	Waterloo, Battle of
Huguenots	Westphalia, Treaty of
Hundred Years' War	World War (I, II)
Jacobins	XYZ Correspondence
July Revolution	

BIOGRAPHIES

Catherine de' Medici	Louis Philippe
Charlemagne	Marat, Jean Paul
Charles (Kings)	Mazarin, Jules
Charles Martel	Murat, Joachim
Charles the Bold	Napoleon (I, II)
Clemenceau, Georges	Necker, Jacques
Dreyfus, Alfred	Ney, Michael
Henry (Kings)	Richelieu, Duc de
Joan of Arc	Robespierre,
Josephine, Marie Rose	Maximilien
Lafayette, Marquis de	Rochambeau
Louis (Kings)	Talleyrand-Perigord

FRANCE, ANATOLE (1844-1924). Born in Paris, the son of a bookseller, Jacques Anatole Thibault used the name "Anatole France" throughout his long career as an author of novels, plays, essays, poems, short stories, and critical works. He was a brilliant satirist and humorist and a master of literary style. In 1921, forty years after the publication of his first novel, *The Crime of Sylvester Bonnard*, he received the Nobel Prize for Literature. His other well-known works include *Th  is*, *The Red Lily*, *Penguin Island*, *The Revolt of the Angels*, and *The Man Who Married a Dumb Wife*.

FRANCIS II (1768-1835). Last emperor of the once-glorious Holy Roman Empire, Francis II of Austria was noted for his ef-

forts to defeat the ambitious designs of Napoleon in Eastern Europe.

Succeeding to his father's Austrian throne in 1792, Francis, with Prussia as an ally, was soon engaged in a French war. Peace was finally made at Campo Formio in 1797. Shortly thereafter, in 1799, he entered an alliance with Russia and England and again attempted unsuccessfully to defeat the Republic of France, losing in the battles of Marengo and Hohenlinden.

In 1804 Francis proclaimed himself Austria's first emperor, but soon after the defeat of Austria and Russia by Napoleon at Austerlitz in 1805, he was forced to give up his title as Holy Roman Emperor. In 1809 he again joined the forces opposing Napoleon, after whose defeat he gained much territory at the Congress of Vienna. Aided by Metternich, he then helped to form the Holy Alliance and ruled as an absolute monarch. See HOLY ALLIANCE; HOLY ROMAN EMPIRE; METTERNICH; NAPOLEON I; VIENNA, CONGRESS OF.

FRANCIS JOSEPH I (1830-1916). In sixty-eight eventful years as emperor of Austria and king of Hungary, Francis Joseph reigned through one of the most tragic periods in the history of Austria and the Hapsburgs. The early part of his reign was beset by internal wars and insurrection; the later part with the events leading up to the First World War. Moreover, his personal sorrows were overwhelming.

In the early part of his reign, dissatisfaction among the diverse elements in his kingdom resulted in the Hungarian uprising, led by Louis Kossuth. Francis was able to put down this rebellion only with the aid of the czar of Russia (1849).

The middle years of his reign were times of comparative peace and calm, and much progress was made through social reforms. Although Francis was dominated at first by his ministers, he threw off their influence in 1852 and began his personal rule. His early governmental policies were extremely conservative, but he later saw the need for a more liberal attitude toward the many different peoples under his rule. His intelli-



THE TRAGIC MONARCH

Francis Joseph ruled Austria-Hungary during its most unfortunate period.

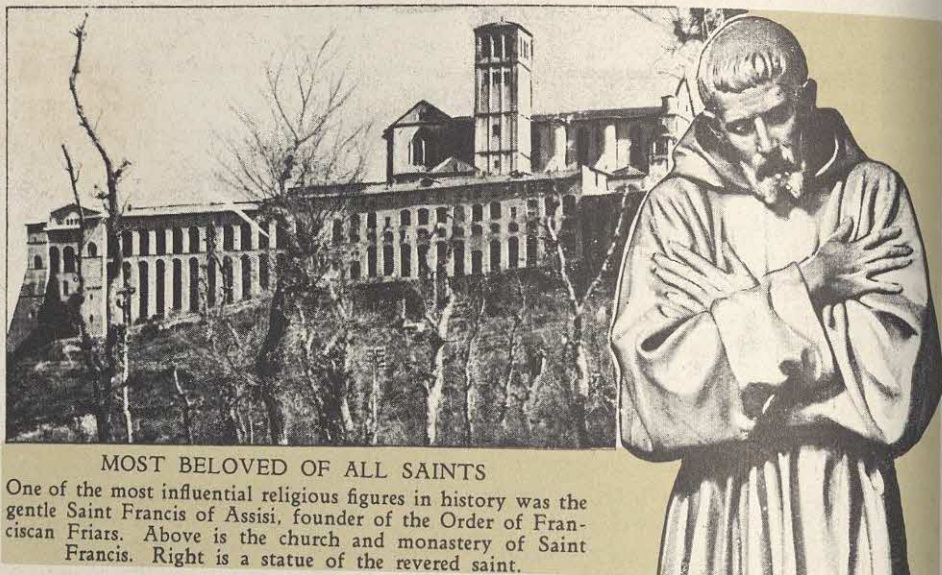
gence and wide knowledge of affairs enabled him to handle most of the details of government.

After the disastrous defeats by France and Sardinia in 1859 and by Prussia in 1866, Francis granted an independent constitution to Hungary and established the Dual Monarchy of Austria-Hungary.

His personal life was a tragic one. His son, his wife, his brother, and his nephew met violent deaths. The nephew was the Archduke Franz Ferdinand, heir to the throne. He and his wife were assassinated at Sarajevo in 1914, and it was this event which led to World War I.

Francis Joseph was succeeded in 1916 by his grand-nephew, Charles, who ruled for only two years. He abdicated in 1918 when the Austro-Hungarian Monarchy collapsed and broke up into several small nations. See AUSTRIA-HUNGARY.

FRANCIS OF ASSISI, *ah se'ze*, SAINT (1182-1226). In all the seven centuries since his time, Francis of Assisi, an Italian monk, has been an inspiration to men and women; and the Religious Order of Franciscans which he founded has, from a small beginning in Italy, spread its influence over the world. Only two years after his death he was canonized as a saint.



MOST BELOVED OF ALL SAINTS

One of the most influential religious figures in history was the gentle Saint Francis of Assisi, founder of the Order of Franciscan Friars. Above is the church and monastery of Saint Francis. Right is a statue of the revered saint.

Francis was born in the town of Assisi, Umbria province, Italy, and was christened Giovanni. But his father, Pietro di Bernardino, often traveled in France and soon began calling the boy Francesco (Francis in English). Following the example of most of the young men of his time, Francis entered the army at an early age. When his first term of enlistment was completed, he wanted to join another army but was forced to return home to recover from an illness.

While at home, Francis decided to give himself to a life of self-denial and preaching. He gathered a small group of men with ideas similar to his own, and together they visited the Pope in 1209 to ask his permission to give up all possessions and live by alms, or begging. When the Pope granted his permission, the Order of the Franciscans was established. The Franciscans rapidly increased in numbers as the work of missionaries sent out by Francis progressed.

By far the largest of the three orders of Franciscans today are the Minorites, or Friars Minor, also called the gray friars. The second order is that of the Poor Clares, an order of nuns established by Clare (Saint Clara). The Tertiaries, or Order of Penance, is the third; this is a secular order, composed of both men and women.

FRANCO-GERMAN WAR. The seeds of the greatest armed struggle the world has ever seen were sowed in the war waged in 1870-71 between France and Germany, the latter under the leadership of Prussia. Caused by Germany's desire for power and French fear of the growing ambition of Bismarck, the Prussian Chancellor, the war was short, ending in utter defeat for the French and the end of her Second Empire. Germany became a united empire. The consequences of the conflict, however, set the stage for the First World War of 1914-18.

Previous to the war, Prussia had taken the leadership of the German Confederation under Bismarck and had successfully waged war against Austria. Prussian power was growing, and Bismarck sought to unite all the German kingdoms under one head. Bismarck's theory was that a victorious foreign war would accomplish this end. France, under the Emperor Napoleon III, was conscious of Bismarck's aims and was fearful of the power a German empire would wield. Moreover, Napoleon believed that a victory would strengthen his tottering throne. When the war was over, Germany was a united empire under the Prussian king, William I, and Germany completely dominated Europe.

The "incident" that started the war was the question of the throne of Spain. Prince Leopold of Hohenzollern was offered the crown. Napoleon objected, fearing an alliance between Spain and Prussia. However, Leopold voluntarily eliminated himself as a possible ruler of Spain; but Napoleon, still fearful, sought a complete renunciation and asked the Prussian king to guarantee it. But Bismarck announced the terms to the Prussian people in such a way that they were angered. France then declared war against Prussia in July, 1870.

Prussia, of course, was fully prepared and sent into the field an army that was twice as large as that of the French. Victory after

victory for the Germans followed, among the most notable being those at Weissenberg and Wörth. Finally, in September, 1870, one French force surrendered at Sedan. Napoleon III was taken prisoner. A month later another French force surrendered. Immediately after Sedan, Napoleon was deposed; and the Third Republic, the present government of France, was set up. Paris tried to hold out against a siege but was unsuccessful; and early in 1871 the war ended with France thoroughly defeated.

The terms of the peace treaty, signed in May, 1871, were bitter for the French. They had to give up the provinces of Alsace and Lorraine, the great industrial centers of



HUMBLING A PROUD NATION

France's defeat in the Battle of Sedan was the climax of the Franco-German war of 1870-71. A humiliating peace deprived France of her provinces of Alsace and Lorraine.



THE CHARM OF OLD GERMANY
Quaint old houses overhang the cobbles in Frankfort-on-the-Main, birthplace of Goethe.

Europe; they were forced to pay to the Germans an indemnity of about one billion dollars; and the German army occupied Paris and several other regions of France until the indemnity was paid.

Inasmuch as the indemnity represented a staggering amount, the Germans believed that France would take years to pay it off; and the Imperial Army prepared for a long stay on French soil. But, by heroic measures, the thrifty French paid the full amount within three years; and the Germans left France, only to return in World Wars I and II (which see).

FRANKFORT, Ky. In the heart of the beautiful blue-grass region of Kentucky lies the city of Frankfort, the capital of the state. Water power from the Kentucky River, on which the city is situated, helps to maintain a number of industrial plants, including factories manufacturing cement, shoes, brooms and twine, and furniture. Distilling is a leading industry. The near-by region is a rich tobacco-producing area, and Frankfort has several large warehouses for storing the valuable leaves.

The city was founded in 1786 by General James Wilkinson on a spot fifty-five miles east of Louisville. Today it is served by railroads, bus lines, and airlines.

Daniel Boone and Vice-President R. M. Johnson are buried in beautiful Franklin Cemetery, which overlooks the city. Other points of interest in Frankfort include the governor's mansion, an attractive State Capitol, a penitentiary, and the old State Capitol, which serves as headquarters for the State Historical Society. The population is more than 18,000.

FRANKFORT-ON-THE-MAIN, GERMANY. Before World War II this ancient West German city was noted for its winding cobblestone lanes, with their quaint medieval houses and churches, and also for its modern University of Frankfort, Opera House, art museums, and libraries. In addition, it was one of Europe's greatest banking centers, the seat of Germany's huge chemical industry, a busy river port, and a leading manufacturing, railway, and airline hub.

When the war ended, much of the city had been destroyed by Allied bombers, but it became the administrative center of the American occupation of Germany, then the economic headquarters of the British-American zone. Within a few years it was rapidly reopening its factories, breweries, and transportation lines; constructing modern boulevards and buildings; and restoring its few remaining historic structures. Today its sights include the restored birthplace of Goethe; the Old Town Hall, with its art treasures; the towering medie-

val cathedral where most of Germany's emperors were crowned; and Palm Garden, with its fine collection of Alpine and tropical plants.

Frankfort lies in the former state of Prussia and on the Main River, which gives it access to the Rhine and the ocean. The Main and a canal connect it with the Danube also. Named for its ancient Frank founders and important since Charlemagne's reign, it was a free city for centuries and was the political center of the German states. Population is over 600,000.

FRANKFURTER, FELIX (1882-)

An Austrian-born lawyer, Felix Frankfurter reached the climax of his career in January, 1939, when President Roosevelt appointed him an Associate Justice of the United States Supreme Court. He was born in Vienna, and was brought to America in 1894. Not only did he have to learn to speak English, but when he was 20 years old he graduated from the College of the City of New York with highest honors. In 1906 he took his degree in law at Harvard.

Frankfurter began teaching law at Harvard, and very soon he was supplying Federal judges with legal secretaries whom he trained. He also advised on appointments to legal positions in the Roosevelt Administration. He is an outstanding liberal of Jewish birth.

FRANK'ING. In the United States there are two distinct laws governing transmission of official matter in the mails free of postage. These are commonly known as the *franking privilege*, which is used by the legislative branch of the government, and the *penalty privilege*, which takes its name from the style of envelopes or wrappers required to be used by the executive and judicial branches of the government.

The terms *frank* and *franking* are applicable only to matter bearing the written name or facsimile thereof of members of Congress and such other persons as have been specifically granted the privilege of transmitting matter in the mails free of postage under their "franks."

The statutes governing the franking and

penalty privileges have varied from time to time, but the foregoing sets forth the existing law. Former Presidents Washington, Adams, and Jefferson were accorded the franking privilege after their retirement to private life.

Through legislation by Congress, the widows of all the late Presidents, beginning with Mrs. Theodore Roosevelt, have been accorded the franking privilege.

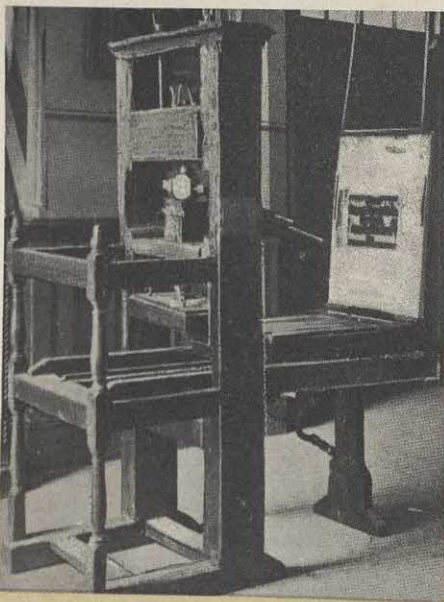


APOSTLE OF THRIFT

FRANKLIN, BENJAMIN (1706-1790)

America might have won the War for Independence without Benjamin Franklin; the Thirteen Colonies might have become the great nation we know today without his counsel and guidance; but it is certain that the United States and the entire world would have been poorer had Benjamin Franklin never lived.

It is impossible to estimate the greatness of this man or to classify him as a philosopher, a statesman, an inventor, a scientist, a publisher, an author, or a humorist. He was all these—and more. He was the very spirit of what was best in the eighteenth century, the symbol of democracy, refinement, culture, kindness, industry, and advancement. He could walk through the gilded corridors of the glamorous palaces of royalty as easily as he could stroll down the



STATESMAN AND PHILOSOPHER

Benjamin Franklin was one of the leading thinkers of the Colonial period. Above are Franklin's old printing press and a view of Franklin signing the Treaty of the Hague.

streets of Philadelphia. He was respected in the company of the world's greatest men as he was admired in his print shop. Probably no other man, not even George Washington, so personified the United States as did Benjamin Franklin.

Early Life. Unlike many of the men who worked with him to found a new republic, Franklin began life as a poor boy, the son of a Boston candlemaker. Born on January 17, 1706, he was apprenticed when quite young to his brother, who was a printer and publisher of the *New England Courant*. Without his brother's knowledge, he wrote for the paper prose and poetry which were quite popular. In 1723 he went to Philadelphia, where he became a printer and friend of Pennsylvania's governor, Sir William Keith. Urged to go to England, he left the colonies and stayed away eighteen months. In 1732, sometime after his return to Philadelphia, he opened a print shop and published a newspaper, the *Pennsylvania Gazette*. In that same year he began the publication of his *Poor Richard's Almanack*.

Scientist and Statesman. Then began his phenomenal career in many fields. He urged and was successful in founding the first circulating library in America. In 1752 he discovered that lightning is an electrical charge. The discovery was made during a storm when he flew a kite with a key on the string. It led to the invention of the lightning rod. He invented the Franklin stove, improved the Leyden jar, and developed other scientific apparatus. Moreover, he founded an academy which later became the University of Pennsylvania.

Franklin launched his career as a statesman in 1757 when he was sent to London as agent of the colony of Pennsylvania. There, at the court of George III and before Parliament, he won great respect because of his intelligence and wisdom, his homely philosophy, and his brilliant wit. He was employed as agent for Massachusetts, Maryland, and Georgia; and, as their representative in the Mother Country, he had an opportunity to study the relations between the colonies and England. Honors were given him. Universities conferred degrees upon him, and he was elected to the Royal Society. He returned to America in 1762, but two years later was again in England objecting to the taxes which the king was placing on the colonies.

In 1774 Franklin presented the petition of the American Congress for the repeal of the Stamp Act; but soon he saw that there was but one course left for the colonies—to declare their independence. Accordingly, he returned again to America, was elected to the Continental Congress, and was the man to whom all turned for advice. He urged the Declaration of Independence and, upon its signing, went to France to enlist aid from that country. There, too, he was well received and was honored by the French statesmen. He negotiated for supplies for the American army, made the first treaty of the new nation in 1778, and, upon the successful conclusion of the war, was one of the men commissioned to bring about a formal peace between England and the United States.

Later Years. Franklin was seventy-nine years old when he returned again to the United States, but he was still active. He became governor of Pennsylvania and, in 1787, was made a delegate to the Constitutional Convention. Again he was the advisor and counselor to whom the delegates looked during the hot and bitter arguments that surrounded the framing of the constitution, and his active support aided in having the document approved.

On April 17, 1790, at the age of eighty-four, Benjamin Franklin died, beloved by the nation he had done so much to found, and remembered by the generations that followed as one of the greatest of all Americans.

His writings, notably his *Autobiography*, give a penetrating insight into his character and vividly picture the life of those stirring times.

FRANKLIN, JOHN, Sir (1786-1847). One of the heroes of the silent Arctic regions was Sir John Franklin, an English explorer who vanished in the wilds during the nineteenth century. Not until years later was any trace found of him or his valiant crew.

Years before his last tragic journey, Franklin had become famous for his accomplishments as a geographer and explorer. While still a youth, he joined the British navy. After eighteen years' service he was given command of the brig *Trent*, which had been fitted out for an expedition to the Polar Sea and the region north of Spitzbergen. Although the expedition was not successful, Franklin brought back valuable information about the hitherto unknown coast of North America which lay between the mouth of the Coppermine River eastward to Point Turnagain.

When he returned to England, he was made a captain and was also elected a member of the Royal Society. In 1829, after another Polar expedition, he was knighted; and later, in honor of his contributions to geography, he was given an honorary degree by Oxford University and a gold medal of the Geographical Society of Paris. Some years after, he was appointed lieutenant-

governor of Tasmania, then called Van Diemen's Land.

In 1845 he set out upon his fatal expedition in command of ships *Erebus* and *Terror*, to find a Northwest water passage to the Pacific Ocean. He never was seen again; but after numerous searching parties had been sent out, a document was finally found which told the details of the trip. According to this paper, Sir John died on June 11, 1847, and about one year later the 105 members of the crews had abandoned the ships and started for the Great Fish River. None, however, survived the trip, but many relics of the party have since been found. In honor of Sir John Franklin, numerous islands that lie north of the mainland of Canada have been named the District of Franklin.

FRANKS, THE. See FRANCE.

FRANZ JOSEF LAND, *frahnts' yo'zef lahnt*. Rising out of the waters of the Arctic Ocean, a group of islands that lie to the north of Nova Zembla comprise what is known as Franz Josef Land. There, on a plateau of basaltic rock, Russia maintains the world's most northerly weather station. The islands range from 400 to 500 feet above sea level, with the highest points rising to about 2,800 feet. On some of the land lichen and mosses and other Arctic plants grow, but for the most part it is covered with glaciers. Russia considers the islands a part of the Soviet Union, but Norway disputes the claim.

FRATER'NAL SOCIETIES, or FRIENDLY SOCIETIES. Group life has long been a part of civilized man's activities. In ancient times men formed clubs for various purposes—athletic, learning, or general amusement. The formation of societies based on the principle of mutual savings for mutual benefits is of fairly recent origin. These fraternal societies, or friendly societies as they are known in England, have grown rapidly and have spread throughout the world. They were first simply groups of friends who organized as clubs to care for one another in illness and occasionally to meet for recreation. A common fund was

maintained to care for illnesses in the group and for funeral expenses.

Some of the clubs became very large and organized branch groups or lodges. Although, in the main, they have retained the ritual and secrecy common to the early groups, these societies have become in a large measure insurance orders, paying numerous benefits, as accident insurance, old-age pensions, and annuities for widows and orphans. Most of them also maintain homes for aged or invalid members.

Leading Organizations. Among the oldest and largest are the Freemasons, the Ancient Order of Foresters (in England), and the Independent Order of Odd Fellows. More than 9,000,000 persons in the United States belong to fraternal societies. The principal societies are:

- Freemasons
- Royal Arch Masons
- Royal and Select Masters
- Knights Templar
- Ancient and Accepted Scottish Rite
- Nobles of Mystic Shrine
- Eastern Star, Order of
- Odd Fellows, Independent Order of
- Modern Woodmen of America
- Woodmen of the World
- Knights of Pythias
- Good Templars, Independent Order of
- Loyal Order of Moose
- Benevolent and Protective Order of Elks
- Knights of Columbus
- Order of Owls
- Order of Eagles
- The Maccabees
- Royal Neighbors of America
- Royal Arcanum
- Improved Order of Red Men

FRATER'NITIES, COLLEGE. For more than a century these "Greek letter" societies have formed an important part of American college life. Some of them are purely honorary, electing to membership high ranking students or those who have shown ability in some particular line or endeavor, as in public speaking or dramatics. Others are purely social and provide group or club life for students. The names of the organizations are letters of the Greek alphabet, as *Chi Psi*, each letter representing the beginning of a word in the secret motto.

Most college fraternities are national in character with chapters, or branches, in major colleges. National officers preside over the combined chapters and national conventions are held periodically. Although generally fraternities are confined to undergraduate students, there are a number of professional fraternities for students, such as law and medicine.

Phi Beta Kappa, the outstanding scholastic honorary fraternity, was founded in 1776 at William and Mary College. The gold key of *Phi Beta Kappa*, usually confined to students of the liberal arts departments, is a coveted college award. *Sigma Xi* is the national honorary fraternity in science; the *Order of the Coif* is a legal fraternity; *Delta Sigma Rho* and *Pi Kappa Delta* are honorary debating fraternities.

With but few exceptions, fraternities are secret societies, with passwords and closed meetings. Among the oldest fraternities are *Kappa Alpha*, founded at Union College, N. Y., in 1825; *Alpha Delta Phi* at Hamilton College, N. Y., in 1827; *Psi Upsilon* at Union College, N. Y., in 1833; *Beta Theta Pi* at Miami College, Ohio, in 1839.

Corresponding to fraternities for men are sororities for women. The two oldest are *Kappa Alpha Theta* (founded at De Pauw University) and *Kappa Kappa Gamma* (Monmouth College), both dating from 1870. Within the next four years, *Delta Gamma*, *Alpha Phi*, and *Gamma Phi Beta* were established.

To supplement college fraternities and to carry on the activities and friendly associations after graduation, alumni chapters have been set up in the major cities. See CLUB; COLLEGES AND UNIVERSITIES; SORORITIES.

FREDERICK II (1712-1786). As father of the great war machine that was to become the most powerful in Europe, Frederick II, king of Prussia, laid the groundwork for the stirring history of modern Germany. He was an extremely able ruler, combining the skill of a general with a keen understanding of foreign and domestic politics. This capability was reflected in the dignified title Frederick the Great and the affection-



FATHER OF GERMAN MILITARISM
A benevolent despot, Frederick the Great gave Germany a famous military system.

ate term *Unser Fritz*, meaning *Our Fritz*, which were given to him by his adoring subjects.

Son of Frederick William I of Prussia and Sophia of Hanover, sister of King George II of England, Frederick spent a childhood under the domination of a stern and harsh father. His father was once on the point of sentencing the son to death for trying to flee the country. As was the custom with royalty, Frederick was forced to marry a woman of his father's choice. In 1740, when Frederick William died, Frederick II ascended the throne with Elizabeth Christina, daughter of the Duke of Brunswick-Bevern, as his queen.

Frederick immediately began to enlarge the power of Prussia by taking over Silesia from Austria, following a war which ended in 1742. After another successful war against Austria, he inaugurated the rigid training of the German army, a system that persisted to the present period and which



HERO KING BOWS BEFORE WARRIOR KNIGHT

Frederick Barbarossa, shown kneeling before Henry the Lion, played an important rôle in the medieval crusades.

accounted for the perfectly trained troops of Germany in World War I. Hearing that Maria Theresa, empress of Austria, was about to attack Silesia, Frederick invaded Saxony in 1756, beginning the Seven Years' War. At the end of the war, he emerged as one of the dominant figures of the eighteenth century.

Turning then to affairs within Germany, Frederick brought about many reforms for the benefit of his people. In 1772 he annexed more territory through the first partition of Poland, and seven years later he curbed the rise of Joseph II of Bavaria. Near the end of his reign he further affected the future of Germany by forming a confederation of the German states. See PRUSSIA; SEVEN YEARS' WAR.

FREDERICK I, BARBAROSSA (about 1123-1190). Among the emperors of the loosely organized Holy Roman Empire, Frederick I stands as one of the strongest and best. Upon the death of his uncle, Conrad III, in

1152, he ascended the throne and began extending his rule in Italy. He was drowned while on a crusade against the Saracens undertaken in 1189, but a popular legend persisted that he would return to rule someday. See HOLY ROMAN EMPIRE.

FREDERICKSBURG, BATTLE OF. An example of the bad leadership under which the North fought early in the American Civil War was the Battle of Fredericksburg. Fought on December 13, 1862, it ended in the complete rout of the Union army under General Burnside and the loss of 12,500 Union soldiers, one tenth of the entire force. Thousands more were wounded. The Confederates, under Lee, lost 4,500.

The battle followed by three months the Battle of Antietam, in which McClellan had checked Lee's first invasion of the North. The Southern army retreated; but McClellan failed to pursue Lee and was dismissed by President Lincoln. General Burnside replaced him and determined to strike a

blow at Lee, who had entrenched his army on a high, invincible bluff. He had to send his men across an open field under the direct fire of the Southern army.

Burnside sent his army charging across the field not once, but six times, each charge being more disastrous than the last. At the end of the day, the army was in retreat and nothing had been gained. Burnside was dismissed. See CIVIL WAR IN AMERICA.

FREDERICK WILLIAM (1620-1688). If Frederick the Great was the father of Germany's military power, then Frederick William, the "Great Elector" of Brandenburg, must be considered its grandfather. It was he who first elevated Prussia to the leadership of the German states and taught the people that their greatness rested in the army.

Coming to power in 1640, he rebuilt his country, which had been desolated by the Thirty Years' War. When he completed this task, he brought renown to Prussia by partaking in successful wars against Louis XIV of France and the Swedes. His victories made Prussia wealthy and a powerful factor in European affairs. See PRUSSIA.

FREDERICK WILLIAM I (1688-1740). Prussia's famed tall soldiers, the envy of other eighteenth-century monarchs, were the result of a whim of Frederick William I, king of Prussia. Lover of military discipline and organization, he brought tall, strong men from many countries to serve with his troops.

A stern and unyielding man, he was the son of Frederick I and the grandson of Frederick William. He came to the throne



BUILDER OF A NEW PRUSSIA

Called the Great Elector, Frederick William welded Prussia into a powerful country after the devastation of the Thirty Years' War.

in 1713, and during the twenty-seven years of his reign took over a considerable portion of Swedish Pomerania. He instituted the rigid system of army discipline later adopted by his son, Frederick the Great (see **FREDERICK II.**).

FREE CITIES. Greatest foes of the nobles of the Middle Ages were the towns and cities of Europe which grew as trade increased. Many of these cities aided kings and emperors in putting down insurrections by the nobles, and, in return, received the right to rule themselves. Called free cities, they were usually bustling, energetic centers, especially in Germany, where there were fifty-one free cities at the end of the eighteenth century. Hamburg, a great German port on the Elbe River, was a free city until 1934.

The Free City of Danzig, comprising the port of Danzig and 754 square miles of surrounding territory, was established by the Versailles Treaty in 1920, but in 1945 was given to Poland. See **DANZIG.**

FREEDMEN'S BUREAU. Created on March 3, 1865, primarily as an agency in the War Department to aid the newly freed Negroes, the Freedmen's Bureau (Bureau of Refugees, Freedmen, and Abandoned Lands) contributed much to the injustice and harshness of reconstruction after the Civil War. Its purpose was to allot land to the Negroes and in other ways to help them in becoming adjusted to their new life; but in its seven years of existence, it only angered the South.

The bureau spent over \$15,000,000, did little for the Negroes except to provide meeting places for them in the Southern cities, and hampered the rehabilitation of the farms undertaken by the white inhabitants. Andrew Johnson, who succeeded President Lincoln, vetoed its extension in 1866, but the bureau nevertheless was continued by Congress.

FREEDOM OF THE PRESS. Wherever men enjoy liberty, there will be found freedom of the press, for it is one of the mainstays of democracy. Freedom of the press allows anyone to print what he pleases

without government or private restrictions. Because of libel laws, however, it is dangerous for anyone to print an untruth about a person.

Freedom of the press is an outgrowth of the eighteenth-century doctrine of liberty, upon which the United States was founded. It is guaranteed in the Federal Constitution; and in Canada, in England, and in France. Freedom of the press is not permitted in autocratic countries, for opinions opposing the government are considered destructive to the state. Thus today we find the press in Russia, Spain, Argentina, and certain other countries distinctly not free, but controlled by the government.

FREEMASONRY. See **MASONRY.**

FREE METHODISTS. Simplicity and plainness—these are the qualities which the Free Methodists endeavor to maintain both in their daily lives and in their church services. The members of this group broke away from the Methodist Episcopal Church in 1860 because they desired a simpler form of worship, organization, and mode of life. They agree with the orthodox members of the Church on religious doctrines. However, they have eliminated the office of bishop, substituting an elective general superintendent. Instrumental music is not permitted in their services, and sermons are all extemporaneous. They maintain about 1,200 churches, with a membership of approximately 47,000.

FREE-SOIL PARTY. Slavery in the territories—one of the most controversial questions of the pre-Civil War period in the United States—was strongly opposed by the Free-Soil party, formed in 1848. Created by a coalition of the old Liberty party and disgruntled Democrats called Barnburners, it nominated Martin Van Buren for President for a second term. The party failed to elect him, but secured nearly 300,000 votes. Fourteen Congressmen were chosen under the Free-Soil banner. Four years later, the Barnburners withdrew, and the party's vote decreased.

The Free-Soil party formed one of the strongest elements in the new Republican

party in 1854, and its policy of opposition to slavery in the territories was adopted by the Republicans in their platforms for 1856 and 1860. See **POLITICAL PARTIES IN THE UNITED STATES**.

FREE TRADE. There are today two theories regarding international trade, namely, *free trade* and *protection*. Free trade is the practice of allowing goods to enter one country from another without the payment of any fees or tariffs. Protectionists, by means of high tariff rates, seek to keep out foreign products that would compete with the home market. Free trade has never been completely adopted by any nation, although for many years Great Britain, with but few exceptions, permitted the import of foreign goods without restrictions. The United States has never maintained an open market, and tariffs have always existed, either for revenue or for the express purpose of protecting domestic products.

The philosophy of Adam Smith, a British economist of the eighteenth century, forms the basis for present-day theories on free trade. Complete free trade, if it could be put into effect, might have certain advantages which would prove beneficial in the long run. If this policy were adopted, each nation would devote its time and industrial energy to producing articles best suited to its climate, resources, and man power. For example, if the United States could produce steel machinery on a larger and cheaper scale than any other country, the United States should devote most of its time to this industry. Argentina, on the other hand, might become the world's leading wheat specialist. Accordingly, these nations would freely interchange wares. In brief, trade would produce a division of labor among nations, with a free exchange of goods, as though no national boundaries existed.

The advocates of the theory, however, are often criticized for ignoring possibilities of war, depletion of resources which would force an unprepared country into other channels of industry, or natural disturb-

ances, such as earthquakes, droughts, and floods.

In actual practice, nations, in the mad scramble for commerce, produce everything that can be sold at a profit. Things which they cannot favorably sell in other countries, they try to sell at home, seeking protection and tariffs to keep out foreign competition. The cost of labor and the standard of living in a country are also factors in trade. An industry with a high wage level may desire protection from outside low-wage nations. Some countries, such as China, can produce goods at a very low price in part because of the exceedingly low wages paid to labor. Even though the articles may be inferior to those produced elsewhere, the price may be so low that other manufacturers find it difficult if not impossible to compete.

During the depression beginning in 1930, those nations which had previously adhered, in some measure, to free trade, gradually erected tariff walls and effected tariff unions or mutual-trade agreements in an effort to retain as much domestic commerce as possible. The fallacy in this policy lies in the fact that when other countries follow the same methods, foreign trade is cut off, and the home market suffers a surplus, resulting in falling prices and economic instability.

In the United States, the Democratic party, as far back as 1830, has been said to favor free trade. When in power, however, it has never put the theory into complete practice, and under the administration of Franklin D. Roosevelt, it even raised tariffs on some articles. See **TARIFF**.

FREEZ'ING. At certain low temperatures, various liquids turn into a solid state and are then referred to as being frozen. Every liquid has a *freezing point*, below which it becomes a solid and above which it will change from a solid to a liquid. The freezing point and the melting point of a substance are usually the same.

If a pan of water is placed in the open air at a temperature of 32° Fahrenheit (0° centigrade), it will start to freeze. If

salt is added to the water, it will take a much lower temperature to solidify the solution. The more salt or other chemicals that are in the solution, the greater difference there will be in freezing temperatures.

The process of freezing has been used to advantage in a number of ways. Frozen water (or ice) is used in cooling foodstuffs in the home. It also provides a number of outdoor sports, such as skating, skiing, and hockey. Frozen carbon dioxide, commonly called *dry ice*, or *carbice*, is so cold that it can burn flesh, it makes water bubble as though boiling, and gives off vapor, really melted carbon dioxide, which resembles steam. The reason for these phenomena is the extreme difference in temperature between the carbice and the other objects, which are "hot" by comparison. Dry ice is used extensively in shipping perishable articles.

Liquids, when frozen, expand to a greater volume. The pressure of the expansion is so great that often bottoms of pans containing water are torn from the sides when the water freezes.

Thermometers are made of alcohol and mercury because the freezing points of these liquids are so low. See EXPANSION; THERMOMETER.

FREMONT, JOHN CHARLES (1813-1890). Born in Savannah, Ga., and educated at Charleston College, S. C., John Charles Fremont became one of America's most active military and political leaders. His first government position was that of topographical engineer, and in following out his detailed plan to make a survey of all United States territories, he thoroughly explored the Rockies. While engaged in this work, he ran into trouble with the Mexican government, led a revolt against it in California, and was thereafter appointed civil governor. When General Stephen W. Kearny arrived in California in 1846 at the head of the United States troops, Fremont defied his authority and was court-martialed for his actions. Later he was pardoned and resigned from the army.

First United States Senator from Cali-

fornia, Fremont was nominated by the Republicans in 1856 as their first Presidential candidate. In this race he was defeated by Buchanan, 174 electoral votes to 114. At the beginning of the Civil War, he was appointed major general and was given command of the Western Department. He overstepped his authority by issuing an order confiscating the property of those who favored the South, and in November, 1861, his assignment was canceled by President Lincoln.

In 1864 a group of radicals nominated Fremont for President, but when he saw how little support he was receiving, he withdrew. Later, from 1878 to 1882, he served as governor of Arizona Territory. In 1890 his commission was restored.

FRENCH, DANIEL CHESTER (1850-1931). Destined to become one of America's greatest sculptors, Daniel French was born at Exeter, N. H. While still a boy, he went to Concord to live. There he became acquainted with the writer, Louisa M. Alcott, who, realizing his ability, encouraged him to follow an artistic career. By the time he was twenty-three, he had completed one of his most famous works, *The Minute Man*, for the centenary of the Battle of Concord.

From this time on, his services were much in demand and he completed several portraits, among which were *Emerson*, *Alcott*, *John Harvard*, and *John Boyle O'Reilly*. *Death and the Sculptor*, one of his finest works, was but one of his many memorial reliefs. Animal groups and the statue of the *Republic* at the Chicago World's Fair of 1893 were other famous French creations. One of his outstanding works is the gigantic statue of Lincoln in the Lincoln Memorial in Washington, D. C., dedicated in 1922. The four marble groups adorning the front of the New York Customhouse are other monuments to his ability. His work shows intelligent understanding of his subjects and is poetical and graceful in interpretation.

French was honored by being elected to membership in the American Academy of



MASTERPIECE OF A MASTER AMERICAN SCULPTOR

Death Staying the Hand of the Sculptor, the work of Daniel Chester French.

Arts and Letters, the National Academy of Design, and the Academy of San Luca in Rome.

FRENCH AND INDIAN WARS.

France and England molded the destiny of the unborn United States in the hundred years before the Revolutionary War. In a series of struggles known as the French and Indian Wars, the race for empire in North America was ended. France relinquished all claims to Canada and the Mississippi Valley; the colonies found out that they were strong and worth fighting for; and the restless settlers of the Atlantic seaboard turned their eyes westward without fear of a hostile nation.

The wars were the American counterpart of the struggles that rocked the continent

of Europe at the time, and were the inevitable result of the conflict between two different theories of colonization. The French were traders, intent on acquiring territory for advancing the fur trade and securing wealth. The English, on the other hand, were settlers and farmers. The French laid claim to all land drained by the Saint Lawrence and Mississippi rivers, while the English claimed all land west of the seaboard where they settled. It was certain that the two opposing systems would clash in a struggle to see which would survive.

King William's War. Preliminary to the more important struggles was King William's War, which lasted from 1689 until 1697. Hardly more than a few isolated skirmishes, the conflict was the fringe of



GENERAL WOLFE WINS NEW FRANCE FOR ENGLAND

Approaching Quebec at night by way of the Saint Lawrence River, General Wolfe and 5,000 men left their boats, scaled the rocky heights, and gave battle to the French.

the bloodier War of the Grand Alliance (or War of the Palatinate) in Europe. France took the offensive and sent expeditions to New York and New England, capturing and killing many colonists. England, countering this move, sent expeditions to seize Canada, but they failed. The outcome availed nothing except an aroused bitterness between the people of the two nations and the feeling that more wars were to come. The Peace of Ryswick officially terminated the struggle.

Queen Anne's War. The future wars that everyone expected were not long in

coming. In 1701 Europe went to war again over the throne of Spain, beginning the War of the Spanish Succession, and France and England resumed their struggle in North America. The English began by sending expeditions from South Carolina into Florida, while the French, who had allied themselves with the powerful and English-hating Algonquian Indians, devastated settlements in New England. England finally succeeded in capturing Acadia (Nova Scotia) and Newfoundland, and at the Peace of Utrecht, in 1713, was awarded the Hudson Bay territory and those two

possessions. The French empire in the west was beginning to be dismembered—the handwriting was on the wall.

King George's War. War-weary Europe remained comparatively peaceful from 1713 until 1740, when armies took the field again to decide the question of the Austrian succession. This was another signal for the battle between France and England in the New World, and at its close neither side had gained anything. But the colonial troops distinguished themselves; they gained valuable experience, and the Englishmen in America began to sense their power. The principal campaign of the war was that against Louisburg on Cape Breton Island, successfully led by William Pepperell of Maine. Although the colonial troops took the town in 1745, it was restored to the French when the treaty of peace was signed at Aix-la-Chapelle in 1748, to the

disappointment of the New England troops which had captured it.

The French and Indian War. During the period of the other wars, English and French settlers were crowding one another and claiming new lands for their own. Bitterness was increasing and an ultimate settlement had to be made. It was decided in the fourth and final war of the contest—the French and Indian War, bloodiest and most decisive of all the struggles in the New World. This time, the battle for America began before the contemporary conflict in Europe—called on this occasion the Seven Years' War.

It was set off in 1754, when George Washington, youthful leader of a force of Virginia militiamen, was forced to surrender Fort Necessity in the western part of the colony. The English decided to retaliate, and General Braddock in 1755 attacked



VICTORY AND DEATH FOR GENERAL WOLFE

After climbing to the Plains of Abraham, the English engaged in furious fighting with the French garrison of Quebec. Wolfe gained the victory which secured English control of North America, but was killed in the battle as was Montcalm, French defender.

Fort Duquesne, where the city of Pittsburgh now stands. He was defeated, and for the next three years the English suffered alarming defeats. Finally, in 1758, Fort Duquesne was captured and the region of the Ohio River was in the hands of the English. Louisburg fell, and later Ticonderoga, Crown Point, and Niagara were captured.

By 1759, the English controlled the entire territory south of the Saint Lawrence River and the Great Lakes. It was apparent that the long struggle for supremacy would be decided in Canada. Quebec was the seat of French authority. If it could be captured, England would control all of Canada. Accordingly, the English, under James Wolfe, invaded Canada in 1759, climbed the cliffs on which Quebec was located, and on a field known as the Plains of Abraham decisively defeated the French, led by Louis Joseph Montcalm. This battle ended the wars in America, and four years later, in 1763, when the Treaty of Paris was signed, all of Canada was ceded to England; Florida and the land east of the Mississippi also became English, and Spain received the vast territory west of the Mississippi. See SUCCESSION WARS.

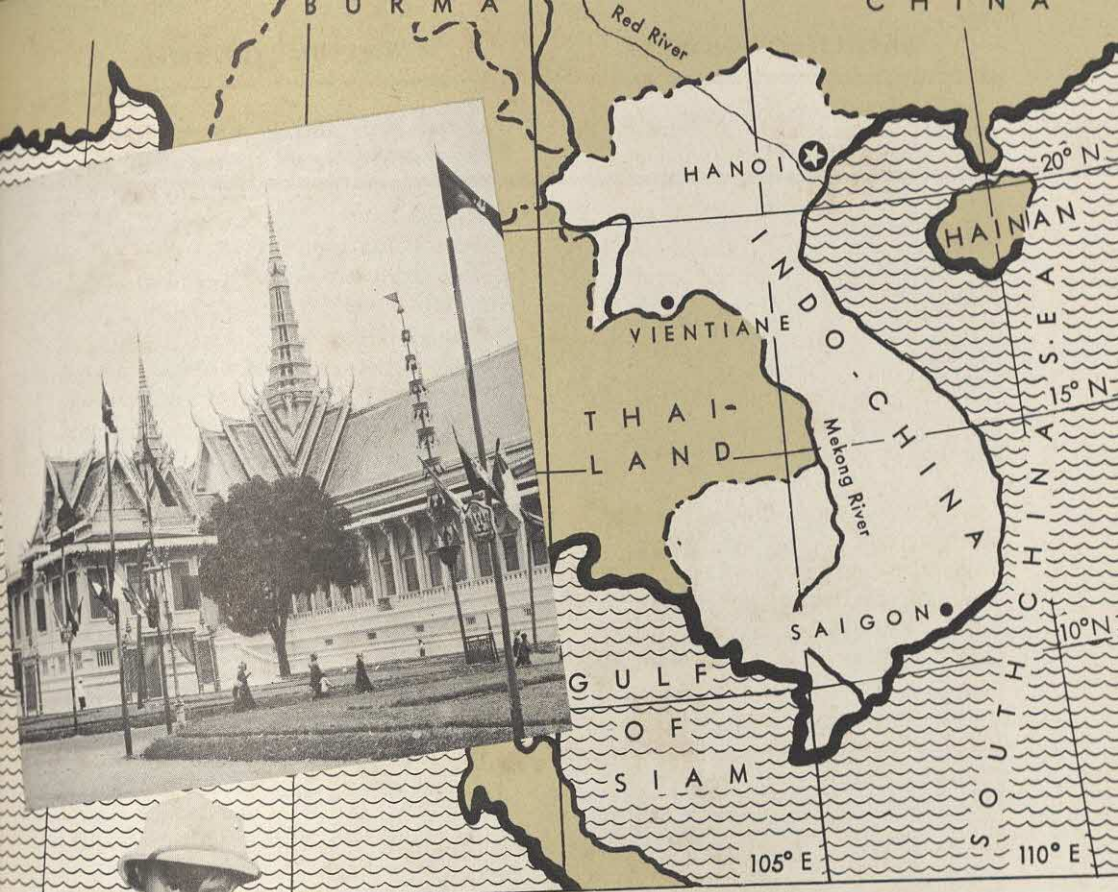
FRENCH COMMUNITY, an association of independent nations which once were part of French territorial possessions. The French Community was formed by the constitution of the Fifth French Republic, October 5, 1958. It replaced the French Union (see FRENCH UNION). By the plan of the French Community, territories were permitted to become internally self-governing states. Most of them chose to do so. In 1959, the plan was broadened to permit these states to become completely independent nations linked in the Community by their own free will. Nations that are part of the Community receive trade preferences and economic aid. African states which became independent in 1960 stayed in the Community. Guinea, however, left it in 1958. Parts of French territory, not yet independent, have some voice in the Community. The French

Community is similar to the British Commonwealth of Nations. See AFRICA, *Political Divisions*; BRITISH COMMONWEALTH OF NATIONS.

FRENCH EQUATORIAL AFRICA was a large colony of France stretching from the Gulf of Guinea northeastward into the heart of the Sahara Desert. Previous to 1910, it was known as the French Congo. In 1960 the self-governing republics of Gabon, Centrafrica, Congo, and Chad were formed from this region and became independent nations. French Equatorial Africa had more than 959,000 square miles and produced cotton, gold, diamonds, coffee, timber, palm kernels, cacao, rubber, and ivory. Its capital was Brazzaville. France dominated the area from 1848 on.

FRENCH GUIANA, *ge ah'nah*. Like a wedge driven into the northeastern coast of South America lie French Guiana, an overseas department of France, and its much larger dependency, Inini. To the west is Surinam (Dutch Guiana); to the south and east is Brazil. French Guiana proper is a narrow coastal strip with an area of little more than 4,400 square miles. Beyond it, in the interior, Inini covers over 30,000 square miles. But all but about 5,000 of the region's 28,500 people live in French Guiana itself. Most of the inhabitants are native Indians and the descendants of Negro slaves.

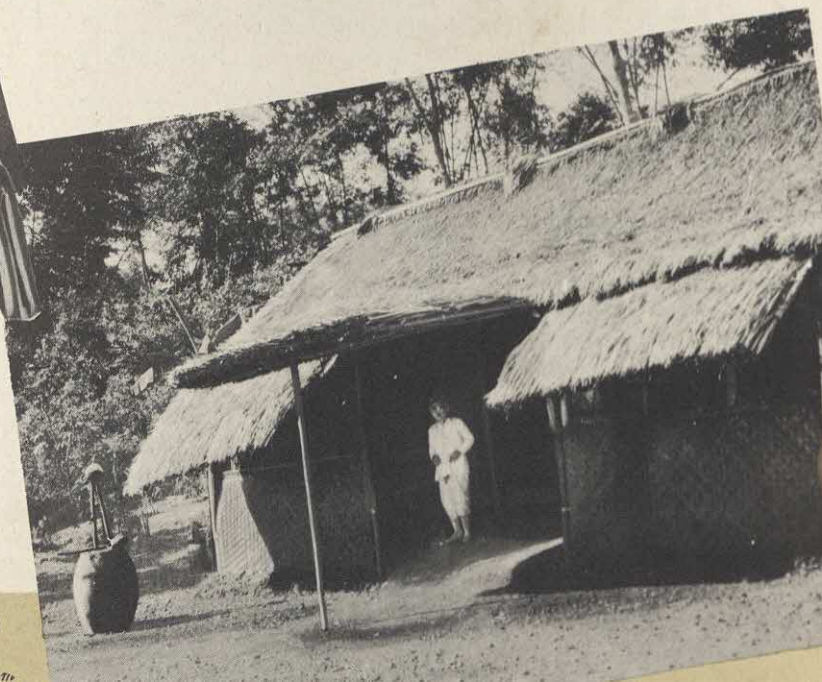
Near the coast the region is low, swampy, hot, unhealthful. The forested, mountainous interior is undeveloped. Only a very small part of French Guiana is under cultivation, and although there is great mineral wealth, gold is the only important mineral export. Crops include rice, manioc, corn, cacao products, sugar cane, and coffee. For many years Devil's Island, off the coast, was a penal colony. The French no longer use it for this purpose. French Guiana, a department in the French Community, elects its own Council-General, and sends representatives to the French Parliament in Paris. Cayenne, Saint Laurent, and Oyapoc are key ports. Cayenne, the capital, has about 12,000 residents.



By Ewing Galloway, N.Y.

N.Y.
CONTRASTS IN THE FEDERATION OF INDO-CHINA

CONTRASTS IN THE FEDERATION OF INDO-CHINA
Above, a royal palace; below, a typical native house; at left, a barefoot schoolboy.



By Deane Dickason, from

FRENCH INDO-CHINA, one of the richest former colonies of France, was located on the Indo-Chinese peninsula of southeast Asia. It was east of Thailand (Siam). France seized Cochin-China (southern Vietnam) in 1861. Cambodia was made a protectorate in 1863, Tonkin and Annam (Vietnam) in 1884, and Laos in 1893. Products of French Indo-China included rice, coffee, rubber, sugar cane, and tea. It had rich mineral deposits of antimony, tin, bauxite, gold, iron. Its area was about 279,000 square miles, and its capital was Hanoi.

After World War II, the Vietminh of northern Vietnam led a war to drive the French out of Indo-China. The Vietminh won in 1954. France was forced to grant independence to Vietnam, Laos, and Cambodia. Vietnam split into North Vietnam (Communist) and South Vietnam.

FRENCH LANGUAGE. Along with Spanish, Italian, and Portuguese, French is a member of the large family of Romance languages. It is a charming, flexible language, through which many fine shades of meaning can be expressed; and it has come to be a second language for many countries. It is the universal speech of diplomats. Most high schools in the United States offer courses in French, and many universities require a knowledge of it before they grant higher degrees.

The history of the French language is known from the first century B. C. When Julius Caesar conquered Gaul, the inhabitants spoke crude Celtic dialects. The Romans, however, brought in their Latin language, and gradually it took the place of the Celtic, except in Brittany, where a Celtic dialect still is used. Slowly Celtic words and habits of speech modified the Latin and many new sounds were introduced, with the result that not only popular speech, but also the language of scholars, underwent a profound change.

With the invasion of the Franks and other Teutonic peoples, still further changes took place. The newcomers, unwilling to bother with the difficult Latin inflections,

used only the simpler forms and incorporated many words from their own tongue, connected mostly with hunting and warfare. Gradually they developed the new *Romanic* language.

Two distinctly different groups of dialects were in use during the ninth and tenth centuries. These were called the *langue d'oc* and the *langue d'oïl*, because the word *oc* meant "yes" south of the Loire River, and *oïl* meant "yes" in the northern and eastern provinces. As the northern provinces gained in political power during the thirteenth century, the *langue d'oïl*, spoken in Paris and the surrounding country, came to be regarded as the official national language, while the *langue d'oc* declined in use. Francis I (1515-1547) forbade the use of Latin at his court and in the courts of justice and declared French to be the national language.

FRENCH LITERATURE. See LITERATURE.

FRENCH REVOLUTION, THE. Every throne in Europe shook, and every monarch in the world trembled, during the ten years of the French Revolution. Beginning with the fall of the Bastille on July 14, 1789, and ending with the overthrow of the Directory by Napoleon in 1799, this tremendous social upheaval rocked the world. It sounded the death knell of absolute monarchies and taught the world that an autocratic government that oppresses the majority of the people cannot endure forever.

Causes of the Revolution. To trace the reasons for the overthrow of the French monarchy and the rule of France by the privileged nobles and clergy, it is necessary to go back many years before the fateful day when an irate mob took history into its hands and stormed the grim prison in Paris. It is necessary to go back in French history at least to Louis XIV. This ruler, who occupied the throne of France from 1643 to 1715, oppressed the peasants, taxed them heavily, mismanaged the finances of the country, and impoverished the nation's industries. Men were thrown out of work, and the crops of the peasants were har-



THE TUMBRELS WHOSE RUMBLINGS SHOOK ALL EUROPE

Aristocrats, public officials, rich men, all who might object to the new order, were summarily guillotined during the French Revolution. Day after day the wretched carts, followed by jeering mobs, jolted their way to the grim Place de la Concorde.

vested to feed the rich. The Church and the State combined to take all they could from the peasants and the workers of the cities.

Things grew no better with the death of Louis XIV. The Duke of Orleans became regent after his death and squandered even more money; and Louis XV, when he assumed authority, continued the practice. The lot of the Frenchman who was not a noble or a priest was an unhappy one in those days. Finally Louis XVI came to the throne. Although he meant well, his administration was wicked and corrupt; his

court, the nobility, and the Church continued to oppress the masses; taxes were increased and finances were in a hopeless muddle. Those who had managed to keep some money became poor. Those who already were poor were reduced to the condition of paupers and beggars. Hundreds of men, women, and children walked the streets of Paris, hungry, bitter, and angry with the aristocrats. In the year 1789 this bitterness was growing to large proportions.

Meanwhile, writers like Voltaire and Jean Jacques Rousseau had published books and stories pointing out the injustices of the

French system of government, and the superiority of representative government. Students read these books and passed on the teachings to others not so well educated. Groups of workers and peasants gathered to discuss matters and plan some remedy. Some of the leaders of these groups were thrown into the Bastille. As conditions grew worse, soldiers and police were called out to break up mobs and prevent the stoning of aristocrats.

Another great factor in bringing about the Revolution was the successful war for liberty waged by the American colonies. The French people looked across the Atlantic and saw that liberty was possible.

One of the immediate causes was the king's dismissal of Necker as finance minister. Necker had been summoned to straighten out the financial situation and had failed to do so. In May, 1789, the States-General, which had not met since 1614, was called. Here, the more progressive leaders sought to change the system of government and take away some of the power of the clergy and aristocrats. The States-General was changed to the Constituent Assembly, a democratic body which would give power to the people. The nobles and clergy resisted this move; Necker was removed from his post, and the people decided that the moment to strike had come.

Ten Years That Shook the World. The first act of the Revolutionists was to storm the Bastille on July 14, 1789. The purpose of the mob which marched to the gates of the ancient fortress was to free the prisoners who had been lodged there unjustly. Although the prison officials resisted, the army aided the mob, and the prison was opened. Immediately the Constituent Assembly, which was led by moderate, freedom-loving men, abolished all feudal rights and special privileges under which the nobles and clergy had oppressed the people. To enforce these laws, a National Guard was organized.

Naturally, such acts as these angered the nobles, but they were powerless. They had

either to accept the new regime or flee the country. Many of them did flee to England, Austria, Spain, and other countries, where they became known as *émigrés*. The government tried to be moderate and just and attempted to prevent disorders; but it was not altogether successful, even in the first years of the Revolution. In October, 1789, a band of women stormed the palace of the king at Versailles, killed the guard, and took King Louis XVI and Marie Antoinette, his beautiful wife, back to Paris as prisoners.

By July, 1790, the new constitution guaranteeing rights to the people was ready, and the king gave his oath to support it. But the people were suspicious of him; and in foreign countries, the *émigrés* were seeking aid to overthrow the people's government. Foreign monarchs, who were afraid their own subjects would follow the French example, wished to restore the old ways to France; but they waited until the time was ripe.

In the meanwhile, the orderly government of the people was becoming weaker. In June, 1791, the king and queen tried to flee the country, but they were captured and forced to take another oath to support the government. In September of that year, the Legislative Assembly was formed, replacing the Constituent Assembly.

Then, when internal affairs were growing worse, France went to war with Austria and Prussia in 1792. Immediately the army began to suffer defeats. Trouble in Paris became more serious. The king was imprisoned and deprived of royal power. Riots broke out in Paris in September, 1792, because of the defeats suffered in the war. But, later in the month, the army started to win; and after the National Convention took over control of the government late in September, the victories were continued.

The Convention declared France a republic similar to the United States, and announced that it would annex Belgium and Savoy to its territory. But this action was fatal. The enemies of France redoubled their efforts; France began to lose its war

From *Engraving Collection*

IN THE NAME OF "LIBERTY, EQUALITY, FRATERNITY"
 Queen Marie Antoinette prepares to ride to her execution during the Reign of Terror.

again. Finances were tangled, and the government was harassed on all sides. No money could or would help her.

Finally the Girondists, who believed in moderation, lost power in the Convention; and the Jacobins, who were more extreme, took their place. The king was tried in December, 1792, and was beheaded January 21, 1793. By June, the Jacobins were in complete control of the country, and a "Reign of Terror" began that was to eclipse everything in history up to that time for wholesale slaughter. First of all, the Jacobins sent the leaders of the Girondists, their fellow revolutionaries, to the guillotine. Next, they executed the aristocrats, even though many of them supported and aided

the Revolution.

The trials were mechanics of justice. The symbol of the Revolution, "Liberty—Equality—Fraternity," was forgotten during the dark days of 1793, for the people went under the yoke of the bloodthirsty Jacobins; hundreds went executed without reason, and fear gripped the population. It was then that huge crowds gathered in the market centers of Paris to watch the executions. Women brought their laundry and sat by the guillotine, washing the words slaughter of human beings. Marie Antoinette and all her court met death. France was shut off from the world, and even the people in other countries who had been sympathetic to the Revolution when it

started, were horror-stricken by the needless killings.

Even some of the Jacobins, who were responsible for the Reign of Terror, began to seek moderation. Danton, their leader, urged less blood and met his death at the hands of Robespierre and his faction. Robespierre, in turn, was executed in 1794, when most of the people decided the executions had to stop; and with his death the Reign of Terror came to an end. The moderate Revolutionists were restored to power, and attempts were made to bring some order out of the chaos. In the meanwhile, France was losing again in its wars. England, the Netherlands, and Spain were victorious.

In 1795 a new constitution was adopted, and a Directory of Five ruled the country, aided by the Council of the Ancients and the Council of Five Hundred, similar to the United States Congress. But the constitution only brought more trouble in Paris, and the National Guard had to be called out to quell the rioting. It was in subduing the insurrections that Napoleon Bonaparte first attracted notice. Because of his success, Napoleon was placed in command of the French army in Italy and won some important victories; but when he went back to France, more losses were sustained.

The government was far from strong. Finances were again in a muddle; and the people, tired of bloodshed, poverty, and unrest, were seeking a strong, central government, even a king again, if necessary. Napoleon, who then was in Egypt, sensed this reaction and returned to Paris. He overthrew the Directory in November, 1799, and assumed the government himself. The Revolution was ended.

The Results. For France, the results of ten long years of bloodshed and trouble were not immediately apparent. The people had killed their king, but, in the end, they had an emperor. The Revolution seemed unsuccessful. In fact, it took France many years to recover. Napoleon was succeeded by Louis XVIII and Charles X, who

restored the old ways of the aristocrats. Then came the Second Republic, then the Second Empire, and finally the Third Republic. All the unrest could be traced to the things which caused the Revolution.

But there were more far-reaching results. The Revolution taught all monarchs that the days of absolute rule were doomed. England instituted reforms to better the lot of the common people. Russia tried reform in 1861. Even autocratic Prussia, with Bismarck as Chancellor, instituted some of the most advanced reforms for the benefit of the people. The Revolution brought war and trouble to Europe for many years, but it changed the entire course of world government; and despite the trouble and unrest that followed in France, the Revolution eventually brought government within the control of the people.

For additional information see:

Bastille	Marie Antoinette
France	Napoleon I
Guillotine	Robespierre
Louis XIV	Rousseau
Louis XVI	Voltaire

FRENCH SOMALI. See SOMALILAND.

FRENCH UNION was the organization of French overseas territories between 1946 and 1958. It gave some of the larger territories more self-government than they had had before 1946, but did not recognize them as nations. The French Community replaced the French Union in 1958. See FRENCH COMMUNITY.

FRENCH WEST AFRICA was a French colony and territory with an area of about 1,816,000 square miles. It extended eastward from the Atlantic Ocean, south of Morocco and Algeria, halfway across Africa. In 1960, the self-governing republics of Senegal, Ivory Coast, Upper Volta, Dahomey, Mauritania, Niger, and the Sudanese Republic, all parts of this former territory, became independent nations; Guinea, another part, became independent in 1958. Products were coffee, cotton, fruits, cacao, timber, and oils. The capital was Dakar.



REMINDERS OF THE GLORY OF AN ANCIENT ART

The modern age is reviving the art of the great medieval fresco masters, mural painting on wet plaster grounds. These two frescoes are in the Church of Santa Chiara.

FRES'CO, or FRESCO PAINTING.

The method of fresco painting is one of the most beautiful and most difficult forms of art developed by man. The painting is produced by water colors made up of minerals or other colored earthy materials, which are applied to walls covered with wet lime or gypsum.

The artist first draws on paper a picture, called a cartoon, the exact size of the wall painting to be made. This drawing serves as a model and is used to trace the picture on the wall. Only a limited portion of the wall is covered with the special plaster at any one time—just as much as the artist can cover without stopping—because the colors must be applied while the plaster is still moist.

The fresco cannot be retouched by the artist; therefore, the work must be carefully, yet hurriedly, performed. When the artist finishes as much work as he can do at one time, all unpainted plaster is removed. It is neatly cut away from the figures on the painted fresco, so that when plaster is

added for more painting, no joining marks will appear.

The popularity of fresco painting began back in the days of ancient Egypt and India. Much of the knowledge of the customs of these countries has been obtained from frescoes appearing in temples and tombs. The art also flourished in Pompeii and among the highly civilized natives of early Mexico. Fresco painting was revived during the Renaissance by such men as Michelangelo, Fra Angelico, and Raphael, who delighted in adorning the walls of public buildings with beautifully executed murals. For several centuries the art declined in popularity, but in recent years it has again attracted interest.

Dry fresco, or tempera. was produced by some of the ancients. It differs from true fresco in that the walls were plastered and left to dry; they were then moistened with lime water before the painting was done.

FREY, fray. In the myths and legends of the Scandinavian people, Frey was the god of joy and sunshine. According to

the stories, the other gods loved him so much that they gave him many presents. One of these gifts was a magic sword which would begin fighting by itself as soon as it was out of the scabbard; another was a ship which could be made large enough to carry all of the gods or so small that Frey could carry it in his pocket; and a third was a boar with golden bristles, which could carry his master with tremendous speed over land and sea.

Frey liked these gifts very much, but when he fell in love with Gerda, daughter of the giant Gymer, he had to give the sword to his servant in order to obtain the latter's help in winning Gerda. In their battles, the gods deeply regretted the loss of the magic sword.

FREYA, *fra' ah*. In Scandinavian legends, Freya was the goddess of love and beauty and the sister of Frey. She was somewhat like Venus, the goddess of beauty in Roman mythology, although she was also regarded as the goddess of war. She often flew down to the battlefields of men, along with the valkyries who carried the slain warriors up to the halls of the gods. Half of the slain heroes were given to Freya, and she provided elaborate entertainments for them in her palace.

FRICTION, *frik' shun*. If there were no friction, automobile and wagon wheels would spin around without advancing, all floors would be as hard to walk on as slippery ice, and neither air brakes nor friction brakes of automobiles would be of any use. Nor would nails or screws hold their places in wood. Friction is resistance to motion between two surfaces which touch each other. It is useful in some friction-drive tractors, in which one wheel turns another in contact with it. But on the whole, friction is more of a hindrance than a help in mechanics. It is the cause of great waste of power, and causes loss of energy even when, because it is unavoidable, the loss cannot be called waste.

Resistance to rubbing is known as *sliding* friction. Even though an axle be as smooth as human skill can make it, a powerful

microscope reveals numerous small projections on its surface. These catch and interlock with similar projections on the axle bearing. But even without the friction thus caused, there is some opposition which molecules offer to sliding.

The resistance met by the surface of a wheel rolling over another surface is called *rolling* friction. It is due to a slight depressing or flattening of the surface of the wheel or the other surface, or both, caused by weight or other pressure; the effect is to make the wheel travel uphill all the time. Rolling friction is always much less than sliding friction.

Oil reduces friction by spreading a thin film which fills up depressions. Ball bearings or roller bearings reduce it by substituting rolling for sliding friction.

Friction that is not overcome is usually transformed into heat.

FRIDAY. The sixth day of the week might be called *friendship's day*, since the syllable *fri* corresponds to the same letters in *friend*. Both words are associated with Frigg (or Frigga), the ancient Teutonic goddess of domestic love and friendship. The fact that Friday has acquired among the superstitious a reputation for bringing bad luck is presumed to be due to the belief that Jesus was crucified on Friday. In connection with the superstition, it is interesting to note that Columbus set sail on Friday, discovered America on Friday, and reached Spain again on Friday.

Friday is the Mohammedan Sabbath. In the Roman Catholic, and to some extent in the Anglican and Protestant Episcopal Churches, it is a day of fasting and abstinence, unless it happens to be Christmas Day, always a joyous festival.

FRIENDLY ISLANDS. See TONGA ISLANDS.

FRIENDS, SOCIETY OF. See QUAKERS.

FRIG'ATE. Naval vessels of the eighteenth and early nineteenth centuries were the fast, trim frigates, forerunners of the swiftest of all sailing ships, the clippers. The frigate had a raised quarterdeck and carried three masts and square sails. Guns

were mounted on the main deck. First designed in England in the mid-seventeenth century, the fighting frigate was improved by the French, finally reaching its height in such ships as the *Constitution*, most famous American vessel of this class. See CONSTITUTION, THE.

FRIGATE BIRD, or MAN-OF-WAR BIRD. This powerful, yet graceful, bird of the tropics received its name from the swooping attacks it makes on sea fowl. The upper plumage of the bird, a relative of the pelican, is glossy black. Under the bill of the male is a pouch which becomes a bright red during the breeding season. At this time, large colonies of the birds build their nests on rocky cliffs or in the tops of tall trees on the islands where they congregate for breeding.

FRIG'GA, or FRIGG. In Norse mythology Frigga was the wife of Odin, who was the leader of all the gods. She was the highest of the goddesses, and corresponds in many ways to Hera, the queen of the goddesses in the legends of the Greeks. Her name still survives in our word *Friday*, which was originally *Frigg's Day*.

FRO'BISHER, MARTIN, Sir (about 1535-1594). Living at the same time as Sir Francis Drake and other great English navigators of Queen Elizabeth's time, Martin Frobisher shared with them the glory of England on the sea. Frobisher was one of those who searched for the fabled Northwest Passage to India, and made three trips into the Arctic regions seeking it. Later he took an important part in the defeat of the Spanish Armada, and finally met his death in an attack on Spain at Brest.

FROEBEL, freb' el, FRIEDRICH WILHELM AUGUST (1782-1852). The kindergartens, where the children of the civilized world receive their early education, owe their beginning to Friedrich Froebel, a famous German educator. The son of a Lutheran minister, he received but a limited education. Unsuccessful in forestry, his first vocation, in 1803 he became a teacher in a model school at Frankfort-on-the-Main. After four years of teaching, he began a



A GREAT ELIZABETHAN NAVIGATOR
Sir Martin Frobisher made three voyages to the Arctic, hunting for the Northwest Passage to Asia.

study of Pestalozzi's methods at Yverdon, following this training with special study at the universities of Göttingen and Berlin.

Froebel fought in the wars against Napoleon, and then in 1816 founded the Universal German Educational Institute at Griesheim. Later he moved it to Keilhau, where he spent many years developing his theories of education. Finally, in 1837, he opened the first kindergarten at Blankenburg, not far from Keilhau.

In founding his school, Froebel followed the basic theories that education and physical development should parallel each other; and that the child's spiritual growth and physical development are intimately associated one with the other. He held that the entire training of a child is based on a good or bad start; consequently, he believed that the start was of profoundest importance. He further maintained that education should satisfy both physical and spiritual wants, and that in the beginning physical impressions are the only method of awakening the child's soul. See KINDERGARTEN.

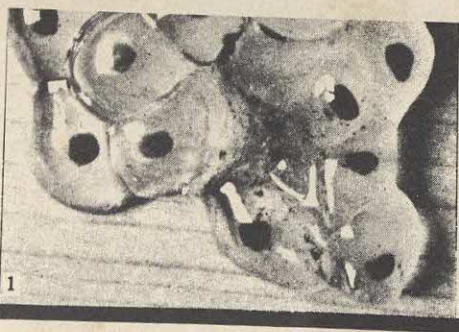
FROG. Belonging with its close relative, the toad, to the group of amphibians, the frog is a cold-blooded animal of interesting habits. Because of the good he does in de-



Travelers Insurance Company

PRIVATE SWIMMING POOL

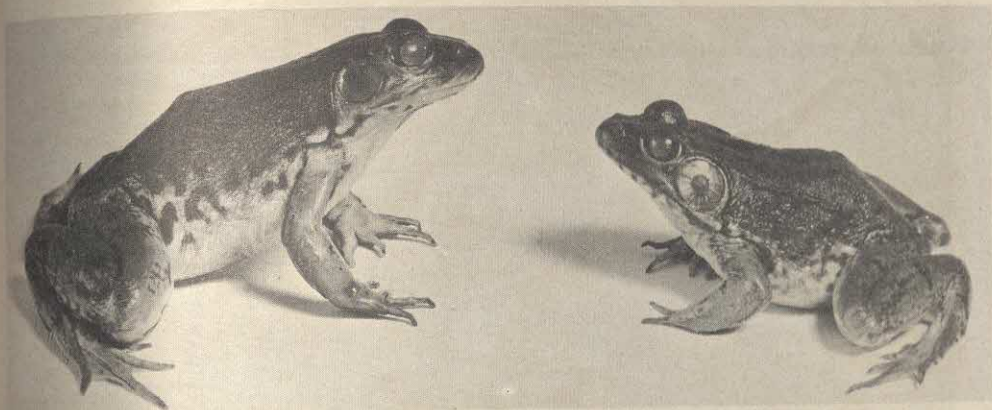
Unlike most frogs that lay thousands of eggs at a time, the *Hyla faber* can lay only a few. For this reason, it guards its eggs in a private pool. The eggs are deposited in a strong corral of mud on the bank of the pond to protect them from fish and insects. The tiny tadpoles remain there until they are strong enough to take care of themselves.



EGGS TO LEGS

The frog begins life in the water in a cluster of eggs, each in its own jelly-like sac (left). Lower left, the eggs hatch into tadpoles, some now beginning to grow legs for use on land. Below, an adult frog, able to live on land or in water, is an excellent source for delicious frog's legs.





U.S. Fish and Wildlife Service

READY FOR A SWIM

The green frog, above, is one of the most aquatic of the frog species and lives in or within jumping distance of a permanent pool. The male has an "ear" larger than its eye.

PREFERRED ALIVE

The pickerel frog, below, is considered more valuable as an insect catcher than for its legs which are poisonous to some people.



A GOOD MIXER

Within an hour the wood frog, above, can change its color from light to dark in order to blend with its woodland surroundings. Its skin lacks any noticeable warts.



Robert C. Hermes from National Audubon Society

BALANCE IN NATURE

The frog balances on his perch, clinging with three feet, while using the fourth to help push a large grasshopper into its mouth. It also helps the balance of nature by devouring many of the insects that would harm the farmer's crops and other vegetation.

stroying insects and because of his market value as food, the frog is worth knowing about.

Like other amphibians, frogs live both in and out of water. They spend the first period of life outside the egg and in the water, as *tadpoles*. A tadpole has a long tail, branching gills, no mouth, and no legs. As it matures, a mouth and hind legs appear, then the forelegs. Gills and tail are absorbed and the creature becomes a full-grown frog, capable of living on both land and water, eating quantities of insects, snails, slugs, and similar food. Frogs lay their tiny eggs in masses or sheets that cling to plants or float on the water. Adult frogs

are from three to six inches in length.

There are several species of frogs in the United States. The *bullfrog*, found as far west as the Rocky Mountains, is described in this work under its own heading. The *green* frog, common in the East, is often found among vegetation at the edges of ponds. It has a call which sounds like "chung" and is often heard during the mating season, from late May to early August. Unlike the bullfrog, it has no ridges down the sides of the back.

The *leopard* frog is spotted on the back like a leopard. The *pickerel* frog differs from the leopard frog in that its underparts are yellow to orange. Light brown in color,

with a dark mark on either side of the head, is the small, attractive *wood frog*. *Tree frogs*, or "sticky toes," have the ends of the toes enlarged into discs with which they may stick to trees. Since they are colored much like the bark, tree frogs are not easily noticed. Cheeriest of all the frogs are the *peepers*, which grow to be only an inch long. They appear early in the spring, and their call can be heard for half a mile. See AMPHIBIANS.

FRONTENAC, *frohN te nak'*, LOUIS DE BAUDE, Comte de (about 1620-1698). Chief among the governors of the French empire in the New World was Louis de Frohtenac, soldier and sponsor of many exploring expeditions.

Appointed governor of New France in 1672, he established several powerful military posts based on the explorations of Joliet, Marquette, and La Salle. He was deposed in 1682, but returned seven years later, successfully checking an English invasion of Canada in King William's War. His last important act was the defeat of the powerful Iroquois Indians in 1696.

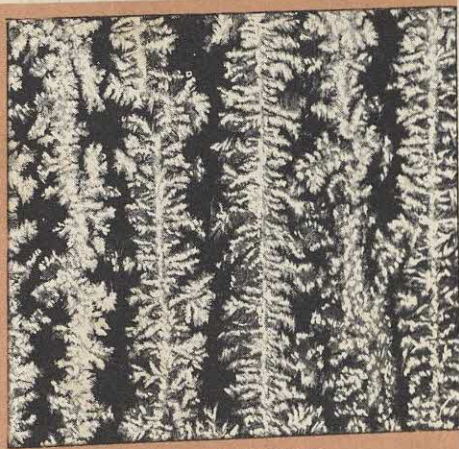
FROST. In the morning, after a clear, cool night, the ground is often covered with the fine, white, snowy substance we call frost. It is neither snow nor dew, but moisture condensed from the atmosphere

and frozen when the temperature is below 32° F. (the freezing point of water). Frost is very harmful to vegetation, as it causes the moisture within the plants to freeze and expand, breaking the delicate tissues. Frosts are divided into three classifications—light, heavy, and killing. A killing frost is harmful to even the hardiest crops.

Frost usually appears after a cold, dry wind has swept the soil during the day. As night approaches and the wind dies down, and the sky becomes clear, the earth loses heat, and moisture condenses. The United States Weather Bureau and its associated stations make an effort to predict frosts from twelve to forty-eight hours in advance, so as to warn crop growers.

Some of the harmful effects of a frost can be prevented by covering plants with glass or screens or by artificially raising the temperature of the area. Oil burners or other types of heaters are commonly employed in orchards to ward off the effects of a frosty night. The subject of frost protection is covered in a Department of Agriculture bulletin, *On Frost Protection*. See DEW; CONDENSATION; FREEZING.

FRUITS. Delightful in appearance and taste, fruits hold high rank among the world's foods. Fruits are raised throughout the temperate and torrid regions of the



NATURE EXECUTES DESIGNS UPON THE WINDOWPANE

When moisture condenses on a cold surface, frost freezes it into beautiful crystalline formations. Left, even fernlike frost pattern. Right, crystals of frosted rivulets.

globe. They may come from trees, shrubs, or bushes. In botany, the term applies not only to the seed of a plant, but to all the parts which cover it.

Among the outstanding fruits of the world are apples, peaches, pears, melons, oranges, bananas, lemons, dates, grapes, figs, cherries, plums, and berries. Important everywhere, the raising of fruit is a leading industry in parts of the United States and Canada. In the United States, States and Canada, where the annual value of canned, dried, and quick-frozen fruits is many millions of dollars.

Nearly all fruits are eaten either raw or cooked, and most of them may be made into jams, jellies, marmalades, and butters. The whole fruit may be canned, preserved, dried, or quick-frozen. Fresh fruits are important to the diet of young and old because they contain vitamins, acids, and salts needed by the body, and their odor digestion and appetite. A natural tonic for the body, fruits are usually a mild laxative and form a valuable natural medicine. Dried fruits and preserved fruits are the most nutritious; in the latter the sugar content is increased by canning. Green or over-ripe fruits should never be eaten.

The common fruits of garden, vineyard, and orchard are described in this work under their own titles.

FUEL. Coal, gas, oil, and any other substances which will burn and produce heat and are available in quantities, are classed as fuels. Liquid fuels and gas are beginning to replace wood and coal, which for centuries have provided the heat for man's home. Because of its comparative cheapness, however, coal still leads as the most important fuel produced in America, for over 500,000,000 tons, on an average, are mined each year.

The high quality and evenness of the heat and the cleanliness of the oil burners are making oil constantly more popular in the cities. Today oil is also used by all naval vessels. A close competitor on land is gas, particularly if the city is located near fields of natural gas.

Wood is still the chief heating material of the farm, although coal is gradually replacing it. Despite the increased use of gas and oil, coal and coke are widely used in industrial processes. In Ireland and other countries where peat bogs are common, large blocks of peat are cut and sold as fuel.

Gasoline, a product of petroleum, is employed in the internal-combustion engines of airplanes, automobiles, and other similar mechanisms. At present, gasoline has no major competitor in this field, although the Diesel engine, as a burner of a cheap grade of heavy oil, has many uses. American motors use billions of gallons each year. In the future, atomic power may take the place of most of today's fuels.

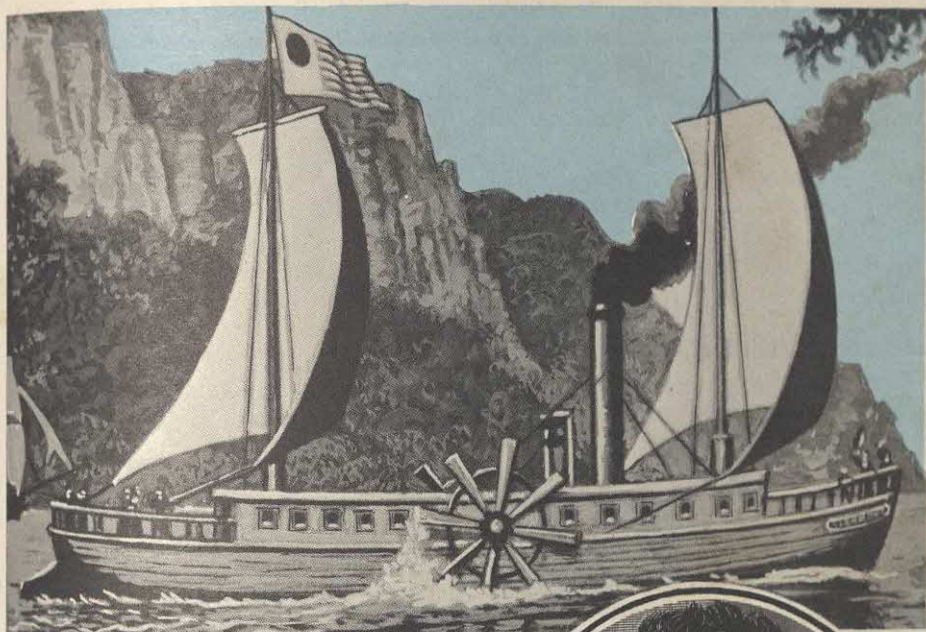
The thermostatic principle of regulating heat is easily applied to gas- and oil-heating equipment.

See the following articles for additional material on the subject:

Charcoal	Gas Engine
Coal	Gasoline
Coke	Peat
Diesel Engine	Petroleum
Furnace	Pipe Lines
Gas, Natural	Thermostat

FUGITIVE SLAVE LAWS. Among the reasons why the United States divided and engaged in a civil war in 1861 was the passage of the Fugitive Slave Laws. Strictest of the several laws enacted in the years before the Civil War was that contained in the Compromise of 1850. It placed authority for arresting and returning slaves who had escaped from their masters in the hands of the Federal government, and prohibited persons from harboring the fugitives.

Laws for the return of escaped slaves were passed by the colonies before the Revolutionary War, and were provided for in the Ordinance of 1787, which created the Northwest Territory. In 1793 a law was passed by Congress permitting the owner of an escaped slave to secure a warrant for his arrest and return from a Federal judge. This law worked imperfectly, and during the ensuing years, many Northern states passed laws forbidding state officials from



STEAM REPLACES THE WIND

Early in the nineteenth century, Robert Fulton (right) put a steam engine in the *Clermont* and journeyed the Hudson from New York to Albany, beginning successful steamboat navigation.

taking part in its operation. The result was the passage of the law of 1850, the enforcement of which caused bitter opposition in the North.

See COMPROMISE OF 1850; DRED SCOTT DECISION; MISSOURI COMPROMISE.

FUJIYAMA, *foo je yah' mah*. See JAPAN.

FULTON, ROBERT (1765-1815). When throbbing engine and churning side wheels first propelled the steamboat *Clermont* at a speed of five miles an hour through the waters of the Hudson River in 1807, the dream of Robert Fulton had been achieved. However, by the time the *Clermont* had proved to be the first successful steamboat in America, Fulton had already acquired fame as an American engineer and inventor, even though he was not the first to experiment with steam navigation (see FITCH, JOHN).

Fulton was born in Little Britain, Penna., and at an early age became interested in landscape and portrait painting. When he



was twenty-two years old, he went to England to study art under the famous American painter, Benjamin West. While there he made friends with Earl Stanhope and James Watt, the inventor of the steam engine. So deeply interested did Fulton become in mechanical engineering, that he abandoned his art studies. By 1794 he had invented several machines. They were a double-inclined plane, which was intended to replace locks on canals; machines for spinning flax and making rope; a mill for sawing marble; and a dredging machine.



PLANT PARASITES OF EARTH, AIR, AND WATER

Fungi must live on other organisms, cannot produce their own starch.

Above, an edible tree fungus. Right, a common type of mushroom.

In 1797 Fulton went to Paris, where he began work on the invention of the submarine. While there, he also exhibited the first panorama ever shown in Paris. He also succeeded in building a steamboat that was given a trial run on the Seine River. Fulton began work on the *Clermont* after he returned to the United States in 1806. He was later employed as an engineer by the United States government. He built the first steam warship in 1814; and when he died a year later, he was at work improving his invention of the torpedo. See SHIP.

FUNDY, BAY OF. Noted for its high and forceful tides, this bay lies between Nova Scotia and New Brunswick, on the Atlantic coast of North America. Into the bay flow the Saint John and Saint Croix rivers. The inner extremity separates the Chignecto Bay and the Minas Channel and Basin. The Bay of Fundy is about 150 miles long and about forty miles wide, with numerous islands, including the Grand Manan, lying at the entrance. The tides which sweep the shores have reached more than fifty feet.

Passamaquoddy Bay, at the southwestern extremity, has the state of Maine for a part of its shore line. The United States government began a project for "harnessing the tides" of Passamaquoddy to produce electric power, but the idea was abandoned as impracticable.

FUNGI, fun' ji. Parasites on the rest of the plant world, fungi comprise a great number of plant groups which have no starch-making green pigment, *chlorophyll*, nor any flowers, seeds, or fruits.

Since fungi cannot make their own food as green plants can, they must be robbers, scavengers, or profit sharers, living on and securing their starch from live or decaying organisms. The robber fungi steal their food from living plants or animals, the scavengers (*saprophytic* fungi) live on dead or decaying matter, while the profit sharers associate themselves with some other organisms in such a way as to give mutual profit.

It is the robber fungi that are agents of disease, since in stealing the food from the plants on which they live, they produce various disturbances in the life and growth of their hosts. The fungi which work their suckers or roots into the cells of living plants for food form one of the principal groups of these strange plants.

Only about 50,000 fungi have been classified, out of a total perhaps three times as large. They are found everywhere as mildew, mold, plant smut and rust, mushrooms, toadstools, "beefsteak" fungus, truffles, yeast, puffballs, etc. Some are edible, some poisonous, some useful to man, some destructive. They grow from *spores*, living cells which are ever-present in the air, the



soil, and the water of the earth. When these spores come under favorable conditions of temperature and moisture, they behave like plant seeds; they grow into mature plants which, in turn, produce reproductive spores and disseminate them.

For further information, consult:

Bacteria and Bacteriology	Mushrooms
Mildews	Rusts

Yeast

FUNGICIDES, *fun' jih sidez*. See INSECTICIDES AND FUNGICIDES.

FUR AND FUR TRADE. No other industry has had such a profound and lasting effect on the history of the United States and North America as the fur industry. It will be remembered that the French entered the Saint Lawrence Valley in the middle of the sixteenth century, later moving into the Ohio and Mississippi valleys to increase the export of valuable furs. The Dutch and English along the Atlantic coast carried on a thriving fur trade with the Indians. Fur trade was, therefore, one of the principle means of bringing about an understanding between the English and the Indians and also played a large part in the westward movement of pioneers. It was the cause of the Russian settlement in Alaska, a territory later purchased by the United States. In the early days of Canada, furs were so important that beaver skins

TRAPPER AND TREASURE

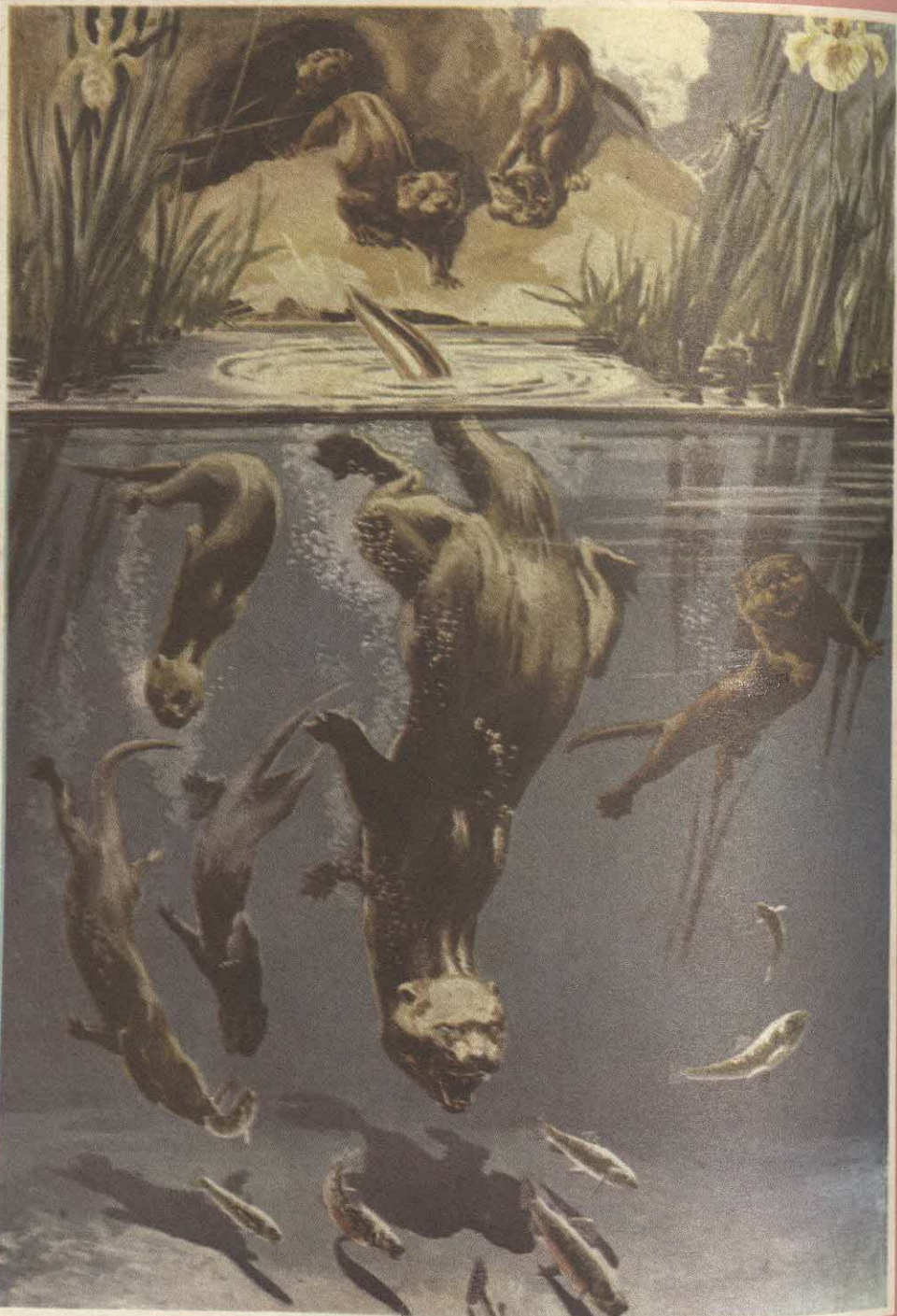
Left, man and dog set out to inspect their trap lines. Right, the prize—a prime silver-fox pelt.

were for a time a medium of exchange instead of money.

Although fur trading and trapping were of great importance in early days, the trade carried on in this field today is even greater. For nearly every country lying within the frigid and temperate zones is a customer of the fur industry. Particularly does this statement apply to the women, who wear fur coats and fur neckpieces for both warmth and beauty. For this reason, the great fur markets buy the year's supply of furs with an eye to the demands of the style centers of the world.

The Work of the Trapper. A fur trapper necessarily leads a life of great hardship and loneliness. He must live far north of the hustle and bustle of civilization. Because the heaviness and quality of fur is governed by the intensity of the cold, the work of catching and skinning fur-bearing animals is seasonal, for even within the Arctic Circle there are periods of comparative warmth.

The trapper usually lives in a lonely cabin and goes out every day to "run his traps." If the route is long, he carries a small tent for overnight stops. His living



FLASHING DEATH IN THE DEPTHS OF A QUIET POOL

Much of the intensive training which young otters get from their conscientious parents is devoted to the fine art of catching fish for food. Streamlined bodies, powerful legs, and strong, webbed swimming feet give these water-loving animals the speed of submarine torpedoes as they hunt beneath the surface of a favorite feeding pool.

FUR DURABILITY

VERY DURABLE

DURABLE

SEMI-DURABLE

SEMI-PERISHABLE

PERISHABLE



SKUNK



RACCOON



OTTER



MINK



BEAVER



KIMMER



FITCH



MUSKRAT



SABLE



PERSIAN LAMB



ALASKA SEAL



KOLINSKY



FOX



NUTRIA



MARTEN



OPOSSUM



SPOTTED CAT



RABBIT



CARACUL



ERMINE



SQUIRREL



LEOPARD



LYNX



CHINCHILLA



MOLE



BROADTAIL
(STILLBORN LAMB)



INDIAN
KID

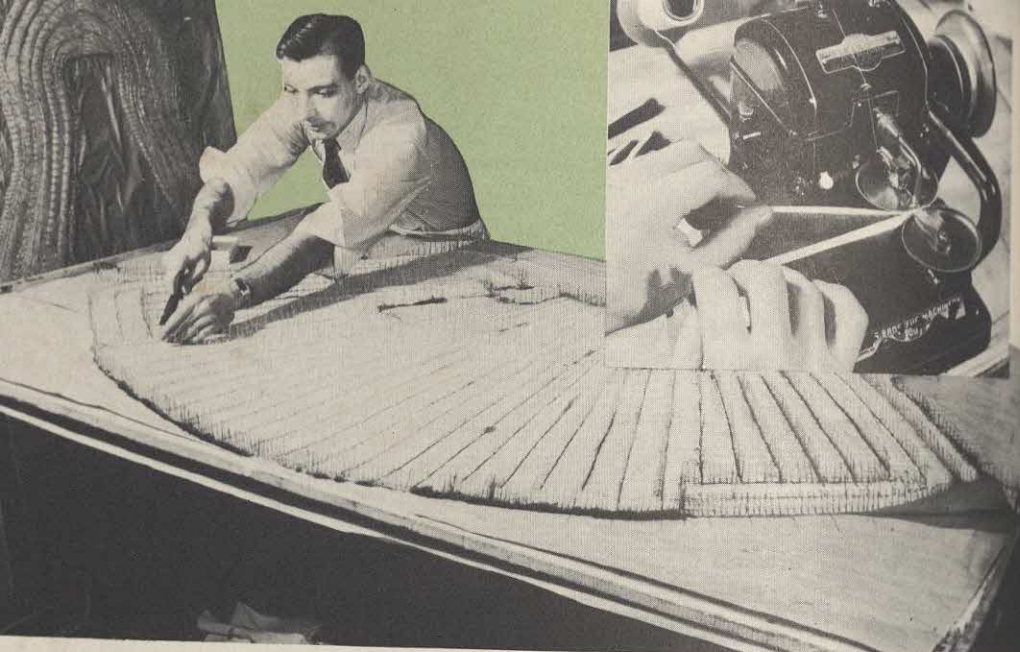
The pelts in this class have two things in common: they are warm, since the fur is thick and soft, and they will wear longer than any others on this chart.

Two of these types of fur, the Alaska Seal and the Muskrat, come from the United States. All of them are comparatively long wearing.

All of the furs in this class are long-wearing if given good care. They are better in scarfs and jackets than in full-length coats.

Three furs in this category — the Caracul, Squirrel, and Ermine — were in ancient times reserved for the nobility or for religious orders. None of the six can stand heavy wear.

The pelts in this group should never be worn for any purpose except beauty. They are extremely lacking in wearability.



Associated Fur Industries of Chicago, Inc.

STAGES IN THE MAKING OF A BEAUTIFUL FUR COAT

Sections made up of sewn strips of fur (right above) are nailed to a chalked pattern.

depends upon his cleverness, his knowledge of animal habits, his energy, his foresight, and, above all, his knowledge of furs and fur prices.

After an animal is caught, it is skinned with a sharp knife. Care must be taken not to cut holes through the pelt and thus lessen its market value. The small particles of fat are then cleaned from the inside of the pelt, and the skin is then stretched. After it has dried thoroughly, the skin is packed with others and is shipped to the fur markets to be sold on a commission basis, or else outright at the nearest trading post. New York, Saint Louis, Chicago, and Montreal are the leading fur markets of North America.

From Market to Manufacturer. The manufacturers buy their furs directly from the great fur markets. The furs selected are cleaned and scraped to remove any remaining flesh. They are then *liquored* in salt water for twenty-four hours to remove grease and to soften them. They are then rinsed and revolved in a cylindrical bath at high speed, after which they are rotated slowly in a revolving drum filled with oak, beech, and birch sawdust. The sawdust is

removed by *caging* the pelts in a revolving drum of coarse wire netting. The furs which are to be dyed are next placed in tanks. The succeeding steps in finishing furs are *beaming* in revolving stone cylinders, pounding to soften them, and, finally, cutting and sewing on special machines. Clipping machines shear the underfur evenly.

Fur Farming, a New Industry. The raising of fur-bearing animals on a large scale was originated on Prince Edward Island in Canada in 1887 by Charles Dalton and Robert Oulton. These men were the pioneers in raising silver foxes, which furnish one of the most prized furs. Now the domestic farming of these and other animals for their pelts is carried on throughout Canada, in many parts of the United States, and in a number of other countries.

Other fur-bearing animals besides the fox are raised on fur farms, including the mink, skunk, muskrat, otter, chinchilla, and Angora rabbit.

In spite of the fact that much of the world's supply of furs comes from these farms, hundreds of trappers in the far north and even as far south as the Gulf of

Mexico still rely on furs for their living. The finest furs are still caught in the frigid areas, for Nature endows these animals with very heavy pelts as protection against severe winters.

Buying Furs. Furs are not all of equal quality and cannot be bought for the same price. Among the most expensive furs are chinchilla, ermine, sable, mink, Russian broadtail, and caracul. Moderately priced furs include badger, beaver, seal, mole, raccoon, squirrel, and red fox. Some of the less expensive furs are bear, civet cat, muskrat, pony, marmot, and Japanese marten.

An inexperienced buyer must beware of camouflaged furs. Sometimes cheap furs are treated and dyed to resemble finer furs. The work is done so skillfully that uninformed people are unable to distinguish between good and poor skins and consequently are deceived in purchasing garments. A good rule to follow in buying a fur coat is to go with a friend who really knows furs, and to buy only from reputable firms.

History of the Industry. Aside from hunting, fur trapping is the world's oldest industry. For in the Stone Age, animals supplied the cave men with both food and clothing. The Chinese are thought to have valued furs for their decorative value for more than 3,000 years. Early Romans, too, favored furs as wearing apparel. The Eskimos have always relied upon furs.

And so it went, throughout the ages. Russia, even in early times, was considered the fur center of Europe, for vast quantities of pelts were brought into the country from Siberia. In both France and England, furs were used in the latter part of the Middle Ages and well into the Renaissance for robes, skirts, bodices, and even nightgowns of royal women. Beaver hats were popular apparel, too.

Then, in 1534, Cartier arrived in Canada. He was so much impressed with the vast quantity of furs there that he obtained a special permit from King Francis I of France to carry on fur trading. Following Cartier came a steady stream of fur traders



Central Furrier

FUR FARMING

Many valuable fur bearers are raised on farms.

who established Montreal and Quebec as trading posts and erected a string of forts reaching from Hudson Bay to the Gulf of Mexico. This advance into the Mississippi Valley, a territory claimed by the English, eventually led to the French and Indian Wars and to the expulsion of the French from the land. Later, England conquered Canada, the last French soil on the North American continent.

The earliest company organized in America for fur trading was the Hudson's Bay Company, established in 1670. About a hundred years later another English company, known as the Northwest Fur Company, was formed. There was immediate rivalry; and, after a long struggle, the two companies united under the name of the Hudson's Bay Company in 1821. This merger, of course, took place long after England had seized Canada for her own. In 1869 all the territory owned by the Hudson's Bay Company was sold to the Dominion of Canada for the sum of \$1,500,000.

FURIES, fu' riz. Three goddesses feared by the ancient Greeks were the Furies, who were supposed to punish evildoers. They were known as the *Eumenides* or the *Erinyes*, and had the power to punish such crimes as murder, perjury, or family disloyalty. They punished by driving the

wrongdoers mad with regret. The Greeks so feared the Furies that they always referred to them as the Eumenides, or *gracious ones*, rather than the Erinyes, or *angry ones*.

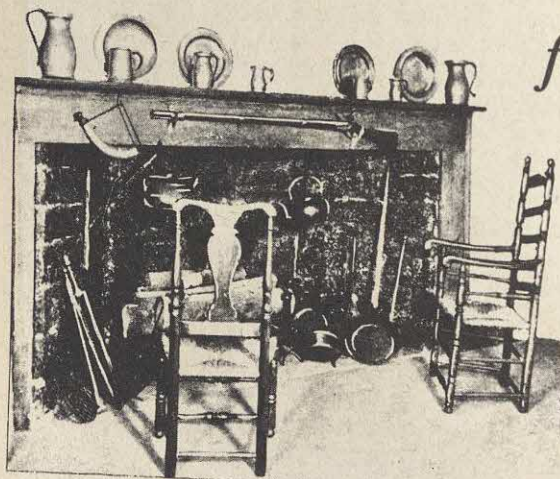
FUR'LONG. This measure of length is commonly used in England. It is equal to 40 rods, 220 yards, or one eighth of a mile. The term is seldom used in America. It means, literally, *length of a furrow*, and is from the Anglo-Saxon.

FURNACE, fur' nas. In the basement of most modern homes is a furnace which supplies the heat and hot water for the entire house.

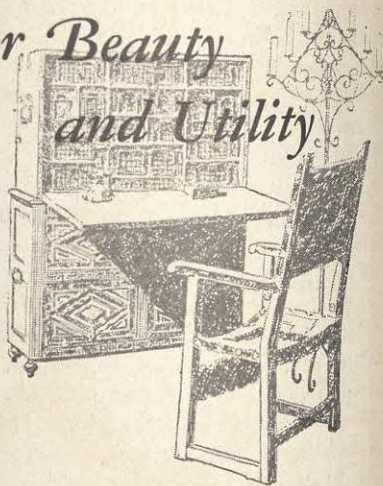
Home furnaces are of several types: hot air, pipeless, steam, and hot water. They differ from the ordinary house stove in that they are surrounded by a jacket which permits air or water to come into contact with

the furnace and, after it is heated, to pass upward by means of pipes to openings in the rooms. In the smaller homes, pipes often are not used. Instead, one large vent, or register, is set in the floor directly above the furnace, and this releases the warm air from below. This type of furnace is very practical and economical. The hot-water furnace operates by means of radiators in the rooms of the house. Water is heated in large boilers by the furnace, and through the pressure created is forced upward into radiators and back to the furnace.

Steam heat is produced in a similar manner, except that the water is made so hot by the furnace that it turns into steam. The steam passing through the radiators gives off the heat, condenses to water, and returns to its source. Boiler attachments to furnaces also provide hot running water.



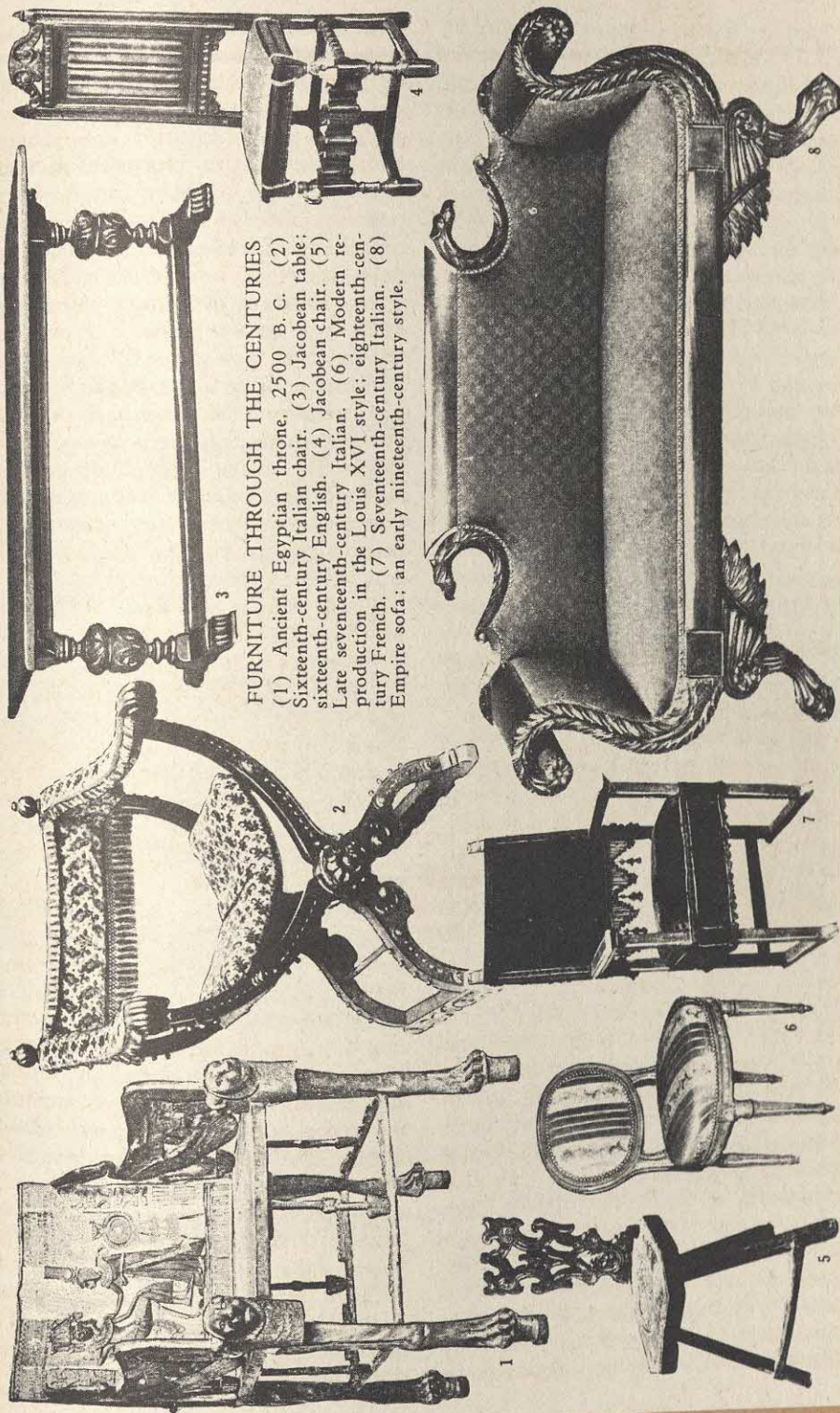
*for Beauty
and Utility*



FURNITURE. From the crude and ugly benches and beds of our ancestors to the modern furniture of today, the design and making of furniture has been of interest to man. In the earliest times, chairs, beds, and tables were the only furniture used in the home. In the Middle Ages, even palaces were not so well furnished as are the most modest homes of today. However, as man became civilized and spent more of his time indoors, he began to think more of the beauty of furniture rather than of its usefulness alone. For a

long time, people have continually sought new designs and ways of making furniture in order to beautify their homes; and many different styles have become fashionable only to be discarded when something newer was produced.

Ancient Furniture. Many of the ancient people had no furniture at all; instead, they sat and slept on the floor. In Egypt only the wealthy people had comfortable chairs, as well as tables, beds, and chests. The Egyptian furniture was made mostly of wood, but it was often inlaid with metal



FURNITURE THROUGH THE CENTURIES

(1) Ancient Egyptian throne, 2500 B. C. (2) Sixteenth-century Italian chair. (3) Jacobean table; sixteenth-century English. (4) Jacobean chair. (5) Late seventeenth-century Italian. (6) Modern reproduction in the Louis XVI style; eighteenth-century French. (7) Seventeenth-century Italian. (8) Empire sofa; an early nineteenth-century style.

or precious stones. Although of simple design, it was elaborately carved and painted with vivid colors. The Greeks borrowed some of the Egyptian designs, but their furniture was comparatively simple, having curved lines and a style that gave the impression of lightness and grace. Greek chairs and couches were very comfortable and, like those of the Egyptians, were often painted in color.

Furniture styles, along with many other phases of Roman life, were copied from those of the Greeks. Metals, as well as carvings of animals, plants, and people, played an important part in the decoration of Roman furnishings. The Romans developed stools and chairs which folded much as do the camp chairs and card tables of today. Later the Romans imported the art and fashions that they found in their travels to foreign lands. In wealthy homes the furniture was decorated with designs of flowers, scrolls, leaves, curves, and circles which later became popular in other parts of Europe. This fashion of intricate design became known as the Romanesque style.

While Greece, Rome, and several Oriental countries were using complicated designs in their architecture and furniture, a new and more simple style was being developed in Northern Europe. In keeping with a younger and stronger civilization, these styles were characterized by straight lines, pointed arches, and high roofs. The new art was greatly influenced by the Christian religion, which stood for simplicity. This style came to be called Gothic, and furniture, as well as churches and houses, were built along these lines. Less elaborate and graceful than the Romanesque, there was nevertheless beauty in the simplicity, and the furniture of this period was strongly made.

Later Styles. With the spread of education and the development of printing at the end of the Middle Ages, the people of Europe became acquainted with the art of the old civilizations of Greece and Rome. Thus began a new period, called the Renaissance, in which the old styles again be-

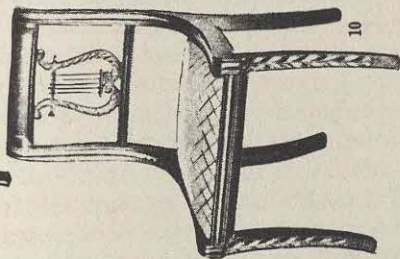
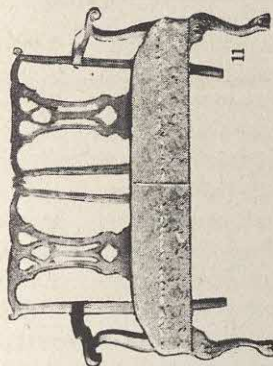
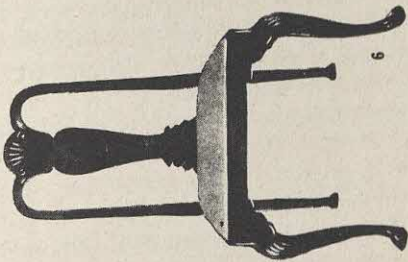
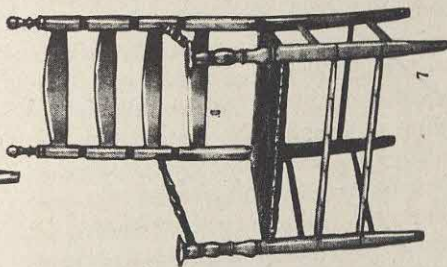
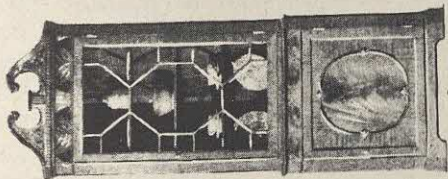
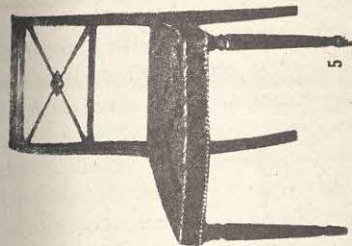
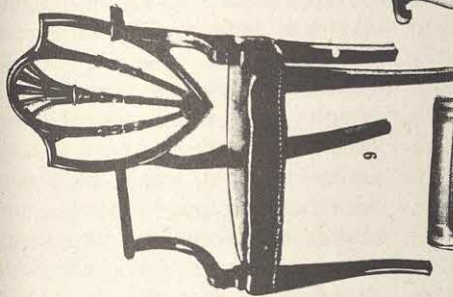
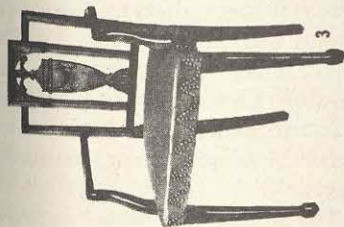
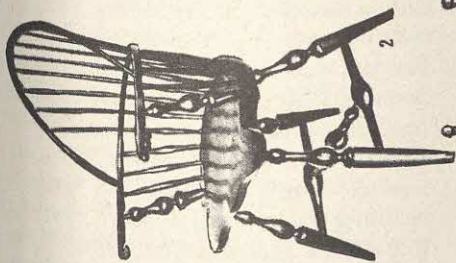
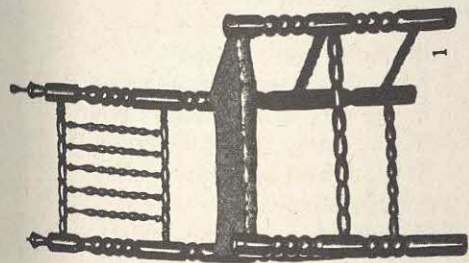
came popular. The furniture of the Renaissance, light and graceful with elaborate decoration, replaced the solid Gothic furniture.

As the people of the various countries preferred different styles, there developed varying fashions, which in the different countries were largely influenced by the preferences of the kings. The Renaissance styles, therefore, came to be named after rulers. Thus the fashions of Queen Elizabeth's reign became known as Elizabethan, and later, during the reign of James I, the Jacobean style was developed. The Jacobean style developed out of the Elizabethan fashions, although it was simpler. When the Puritans came into power in England, they brought in a much simpler style; but when they were succeeded by Charles II, the elaborate and decorative design once more became popular.

It was during the Renaissance period that Europeans started colonies in America. Their homes were crude, and the furniture was rough and simple. Most of the colonists were poor, but even those who could afford European furniture found it difficult to obtain because the small ships had space for carrying only the supplies that were really needed. As a result, the colonists had to hew their pieces of furniture out of logs with knife and ax.

Later, however, the colonists were able to buy the costly European furniture; and as this market developed, many craftsmen moved to America and set up furniture shops. For a long time American furniture closely followed the styles of Europe and changed when they did, although to a certain extent the styles were adapted to fit the materials and needs of the colonists.

When William and Mary came to the throne of England, a new style in furniture, named for them, developed. Queen Mary was interested in furnishings and liked slender, graceful furniture. In the William and Mary style, a Dutch influence was evident. The furniture, usually made of walnut, had slender legs and curved stretchers, which were often painted in



FASHIONS IN FURNITURE

- (1) Seventeenth-century American chair.
- (2) The American Windsor.
- (3) Classic Adam style; eighteenth-century English.
- (4) Adam table.
- (5) Early Sheraton; eighteenth-century English.
- (6) Queen Anne.
- (7) Early American "ladderback."
- (8) Modern Chippendale cupboard.
- (9) Hepplewhite; eighteenth-century English.
- (10) Duncan Phyfe; nineteenth-century American.
- (11) Chippendale settee.

colors. The chairs were usually upholstered. During the reign of Mary's sister, Anne, furniture became even more slender and graceful, upholstery was used more widely, and high-posted beds were hung with elaborate draperies. In deference to the large skirts that women wore, chairs were made with wide seats.

During the reign of Louis XIV, French furniture was large and massive, made of heavy wood. When Louis XV came to the throne, furniture changed to a lighter and more graceful style and was elaborately decorated with inlays, veneers, and painting. Marie Antoinette, wife of Louis XVI, favored still more elaborate styles, which included carvings of flowers.

Following the reign of Anne, English styles were greatly influenced by those of France. When George I became king in 1660, England entered its most famous period of furniture design. There were several designers of furniture who became so famous that their names were given to the styles that they created.

The most famous designer was Thomas Chippendale. His furniture was strong, slender, and graceful, with carved decorations, many of which were patterned after Chinese designs. George Hepplewhite was another designer who became famous. His styles were light and graceful, and his decorations consisted of inlay work. He is noted for the winged easy chair which he designed. Robert Adam, an architect, designed small and ornate furniture, based on Roman and Greek styles, to furnish the houses that he built. The last of these great designers was Thomas Sheraton, whose slender furniture had very elaborate designs and sweeping curves. He is noted for his designs for beautiful bookcases and sideboards. See CHIPPENDALE, THOMAS; SHERATON, THOMAS.

American Furniture. Although American furniture largely followed the style set in Europe, it had simpler lines, and more carving and less inlay work. It was usually made of American wood, although mahogany became popular in America

earlier than in Europe. After the Revolution, American furniture makers began adopting styles of their own. The most famous American designer was Duncan Phyfe; his style is characterized by concave, curved legs often made in the shape of a lyre. He used classical designs and brass mountings, and most of his furniture was made of mahogany.

While the people of the United States were busy developing their country, little attention was paid to architecture or to furniture styles. Anything that was useful and serviceable was satisfactory. As some people became rich, a desire to display their wealth often resulted in ornate decoration that was both hideous and useless. Houses were large and were built with cupolas and complicated carvings, and the furniture was massive and covered with expensive decoration.

However, with the twentieth century there came a desire for simpler and more beautifully made furniture. Many of the older styles, such as Chippendale and Duncan Phyfe, have regained their popularity. The modern furniture styles have a simple beauty and usefulness that is made to harmonize with the designs of modern buildings.

The Furniture Industry. Today the United States is one of the world's leading countries in the manufacture of furniture. The value of the products of the American factories, located chiefly in New York, Chicago, and Grand Rapids, Mich., is nearly half a billion dollars yearly. Many materials are used; and although several of the older styles are combined, the design of most of the furniture cannot be said to belong to any definite period. Modern designs are usually simple, with little carving or inlay work.

The woods most commonly used are oak, maple, pine, beech, birch, gumwood, mahogany, walnut, and rosewood. Because of the high price and scarcity of many of these woods, much of the modern furniture is veneered. In veneering, thin layers of costly wood are glued to less expensive wood.

Veneered furniture, however, is often very expensive. In marquetry, several kinds of wood are veneered on the foundation in an ornamental design. Many woods are stained, painted, or enameled in making modern furniture.

Willow is often employed in making porch furniture, used especially in the summer. Wicker furniture made with woven grass or wire covered with papier-mâché is popular for summer use. Flexible steel is also used for general-purpose furniture.

FUR SEAL. See **SEAL**.

FUSE. In blasting operations, a fuse is a long tape or cord impregnated with materials that burn slowly. One end of the fuse is in contact with the explosive; the other end is lighted far enough away from the charge to permit the blasters to get out of the danger zone of the explosion.

Impact and time fuses are devices fitted at the nose of artillery shells to detonate them on striking an objective, or at the end of a predetermined length of time. The proximity fuse detonates the shell within effective range of the target.

Electric Fuses. Every electric circuit is heated by the current it carries. The heat produced increases as the current increases. In case a wire is required to carry a current beyond its capacity, it may become so hot as to melt. Wires thus overheated are dangerous, in that they set fire to any near-by inflammable article. It is said that the greatest fire hazard in a building is its electric wiring.

To protect electric wiring from overheating, fuses of metal which melt easily are placed in each circuit. In a case of emergency, the fuses melt and thus stop the current by breaking the circuit. Each fuse consists of a short piece of wire or sheet metal enclosed in a fireproof receptacle. The wire is of such size and material that it melts and breaks the circuit when the current becomes too high for safety.

Fuses are used to protect electrical machinery and the wiring in buildings. In a power station there is a fuse in every line that carries current. These fuses protect the

generator from being overloaded. There are always fuses where electric wires enter a house. These fuses (which are usually in plugs that screw into place like a light globe) protect the meter that measures the current, and also the wiring and fixtures in the house.

Fuse Plugs in the Home. When the electric lights suddenly go out in the house, a burned-out fuse plug will often be found in the box near the meter. If only part of the lights are out, a plug is almost always the key to the trouble, for usually there is more than one circuit in a house. The cause of the trouble is usually an attempt to get too much work out of the electric supply; or it may be a short circuit. Thus, putting on all the lights in the house, turning the washing-machine when the motor is in gear, or using a toaster of too great a current capacity, may blow a fuse; using apparatus with defective insulation or a broken socket may also cause a fuse to burn out. The troublesome part should be disconnected before a new fuse plug is inserted, or the worker may get a shock.

Extra plugs should always be kept on hand. It does not pay to patch a plug by inserting a penny, or by any other means, for a fire may result.

FUSING, fu' zing, POINT. See **FUSION**; **FREEZING**; **MELTING POINT**.

FUSION, fu' zhun. Melting and fusion mean the same thing in science. The point, or temperature, at which a solid material melts is called the fusion point.

For ice, the fusion point is 32° F. The fusion point of mercury is -104° F. At that temperature, mercury will become either a solid or a liquid; that is, if it is a solid, it will become liquid at a point slightly higher than -104° F.; if it is already liquid, it will solidify at a point slightly lower. Fusible metals are those which can be melted.

A fusion party in politics is one which is made up of two or more factions which agree to support the same candidate or program. Fusion parties are effective in defeating strong, single parties.



G. Graceful *G*, seventh of the letters in the alphabet, is one of the few members of the family of letters that was not originated by the Phoenicians. In fact, it was not until the Romans wished to include a symbol for its harsh sound, such as occurs in our word *go*, that it was even known. The Romans invented it by placing a horizontal bar over the tail of the letter *C*.

GABON, REPUBLIC OF, a republic formed from French Equatorial Africa. It faces on the Atlantic Ocean and is bounded also by Spanish Guinea, the Cameroonian Republic, and the Congo Republic. It became independent August 17, 1960. Its area is 103,000 square miles, and its population is about 404,000. Its capital is Libreville. It had been self-governing since 1958.

GABRIEL. In the Scriptures, Gabriel is the archangel who announces to man the purposes and commands of God. He appeared to Mary in a vision and told her that Christ was to be her son. He appeared to Daniel also, and to Zacharias to announce the birth of John the Baptist.

GADFLY, or HORSEFLY. Most gadflies resemble very large houseflies. They like to live near water in the woods. The females suck the blood of horses and deer, and some species will bite man. They are swift in flight.

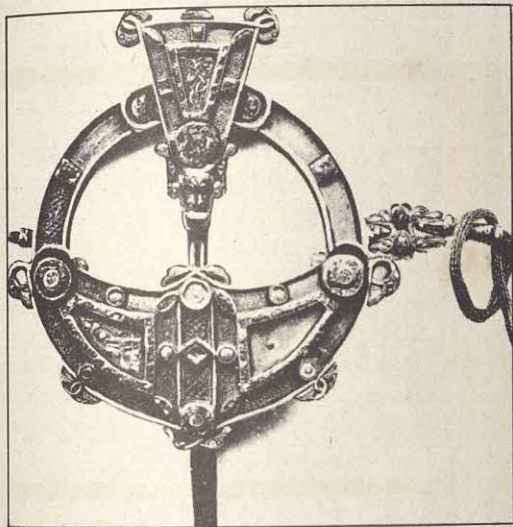
GADSDEN PURCHASE. To settle a boundary dispute with Mexico after the Mexican War, the United States purchased a section of land in the southern part of what is now Arizona and New Mexico. This land became known as the Gadsden Purchase because negotiations were carried

on by James Gadsden, minister to Mexico. The negotiations were begun in 1853, and the treaty was ratified by the United States Senate the following year.

The territory included in the purchase was bounded on the north by the Gila River, on the east by the Rio Grande River, on the west by the Colorado River, and on the south by an arbitrary line. The price paid was \$10,000,000, and the area of the land was about 45,535 square miles. The Gadsden purchase met with much opposition in Mexico.

GAEL, gale. The Gaels, who belonged to the Celtic race, lived anciently in the highlands of Scotland, the Isle of Man, and Ireland. While these groups were largely absorbed by the influx of other peoples, their dialects have remained distinct. The Gaelic dialect of the Scots is widely used, and the children of the Isle of Man are taught Manx, a Gaelic dialect, as well as English.

After the Irish Free State was organized, Gaelic was chosen as the national language. At one time the English had forbidden the use of Gaelic in Ireland, with the result that its use survived only in isolated regions. However, the Irish were proud of their ancient language and literature, and



MAGNIFICENT HERITAGE OF THE EMERALD ISLE

The Gaels were the predecessors of the modern men of Ireland and left monuments to their craftsmanship. Left, the Tara iron brooch. Right, a huge granite cross.

efforts were made to preserve them. Patriotic groups, including the Gaelic League, which was organized in 1893, worked to protect this culture, and through their efforts Gaelic has been preserved, although English is still commonly employed. From 1937 to 1949 Ireland was known officially as Eire, the ancient Gaelic name for the country.

GAGE, THOMAS (1721-1787). The British troops which attempted to seize colonial military supplies at Concord in 1775 acted under orders of Thomas Gage. He also was in command at Bunker Hill, but in the fall of 1775 returned to England and took no further part in the Revolutionary War (see REVOLUTIONARY WAR IN AMERICA).

A native of Sussex, England, he had distinguished himself in the French and Indian War, becoming commander in chief of the British forces in America at its close. He was stationed at Boston in command of troops in 1768. In 1772 he went to England, and two years later was sent back to Massachusetts as military governor. By his strict enforcement of the hated Boston Port Bill and Navigation Acts, he aroused great resentment, and his order to seize the army stores at Concord precipitated the Revolu-

tion.

GAINSBOROUGH, gaynz' b'ro, THOMAS (1727-1788). All who admire the classic beauty of eighteenth-century art are familiar with *Blue Boy*, the famous portrait by the English artist, Thomas Gainsborough, who was born at Sudbury, Suffolk. One of the finest of England's excellent portrait painters, Gainsborough had for his subjects some of the leading figures of his day, including King George III and members of the royal family, the actor Garrick, Mrs. Siddons, Edmund Burke, William Pitt, and William Blackstone. Although he specialized in portraits, Gainsborough also was a skilled painter of landscapes. *The Harvest Wagon*, *Rustic Children*, *The Cottage Door*, and *Duchess of Devonshire* are some of his other well-known works.

GAL'AHAD, SIR. Purest in heart of all the knights of King Arthur's Round Table was Sir Galahad, a character in the stories of the Holy Grail. Son of Lancelot and Elaine, he wandered far in search of the Grail. His quest is described in Tennyson's *Idylls of the King*. There is a well-known painting of Sir Galahad executed by the English artist, Watts. See GRAIL, THE HOLY; ARTHUR, KING.



THE DUCHESS OF DEVONSHIRE

Master of portrait and landscape alike, Gainsborough achieved undying fame.

GALAPAGOS, *gah lah'pah gohs*. West of Ecuador, in the North Pacific, lies a group of volcanic islands known as the Galapagos; fifteen are of some size. There, mammoth turtles and animals strange to other parts of the world bask in the sun, attracting tourists and scientists from all over the world. Visited by Charles Darwin in the 1830's, the islands are owned by Ecuador and are officially known as Colón. The Galapagos produce little of value except sulphur. Their area is about 3,000 square



HIS WAS THE STRENGTH OF TEN

miles; the population, less than 1,000. Some of the rugged mountains on the islands are 5,000 feet high. The group is 600 miles from the South American mainland.

GALATIA, *ga lá'she ah*. Lying in the plateau region in the central part of what is now Turkey, Galatia was a large province first settled by the Gauls in the third

century B. C. The region was divided into several provinces after it had been taken by invading Roman armies under Augustus.

Galatia is mentioned in the Bible in connection with one of the letters of Paul, *The Epistle to the Galatians*. In this letter Paul warned the Christian churches of Galatia to remain true to their religion and to ignore those who were attempting to make them adopt Jewish religious customs. He also states his defense against charges made by some of his enemies. This is one of the earliest letters that Paul wrote, and is the ninth book of the New Testament.

GAL'AXY. See MILKY WAY.

GALE'NA, or LEAD GLANCE. Principal source of lead, galena is a very common, heavy, black, metallic mineral occurring in crystal cubes. Galena is the ore from which lead is derived. When pure it is 86.6 per cent lead and 13.4 per cent sulphur. It is widely distributed in beds and in veins, and in small masses in limestones, slates, sandstones, and crystalline rocks such as granite and gneiss. It often carries silver, and is frequently associated with zinc ores. In the United States it is mined chiefly in Missouri and Wisconsin, and in the Rocky Mountains; in Canada, in British Columbia and Ontario. See LEAD.

GALICIA, ga lish'i ah. Lying to the north of the Carpathian Mountains, in Central Europe, is the district of Galicia. It formed the southern part of the Republic of Poland from 1923 until the partition of that country in 1939. Galicia is one of the richest agricultural districts in Central Europe, and most of the people are engaged in farming and cattle raising. The chief agricultural products are grain, potatoes, and sugar beets. The region is rich in timber, coal, and petroleum, and in recent years oil refining has become an important industry in Southern Galicia.

Galicia was first settled by the Germans, who, in the Middle Ages, were driven out by Ruthenians and Poles. Internal strife so weakened the province that it fell prey to the Hungarians and later the Rus-

sians. In the middle of the fourteenth century, Poland annexed the country and controlled it until it became a part of Austria in 1772.

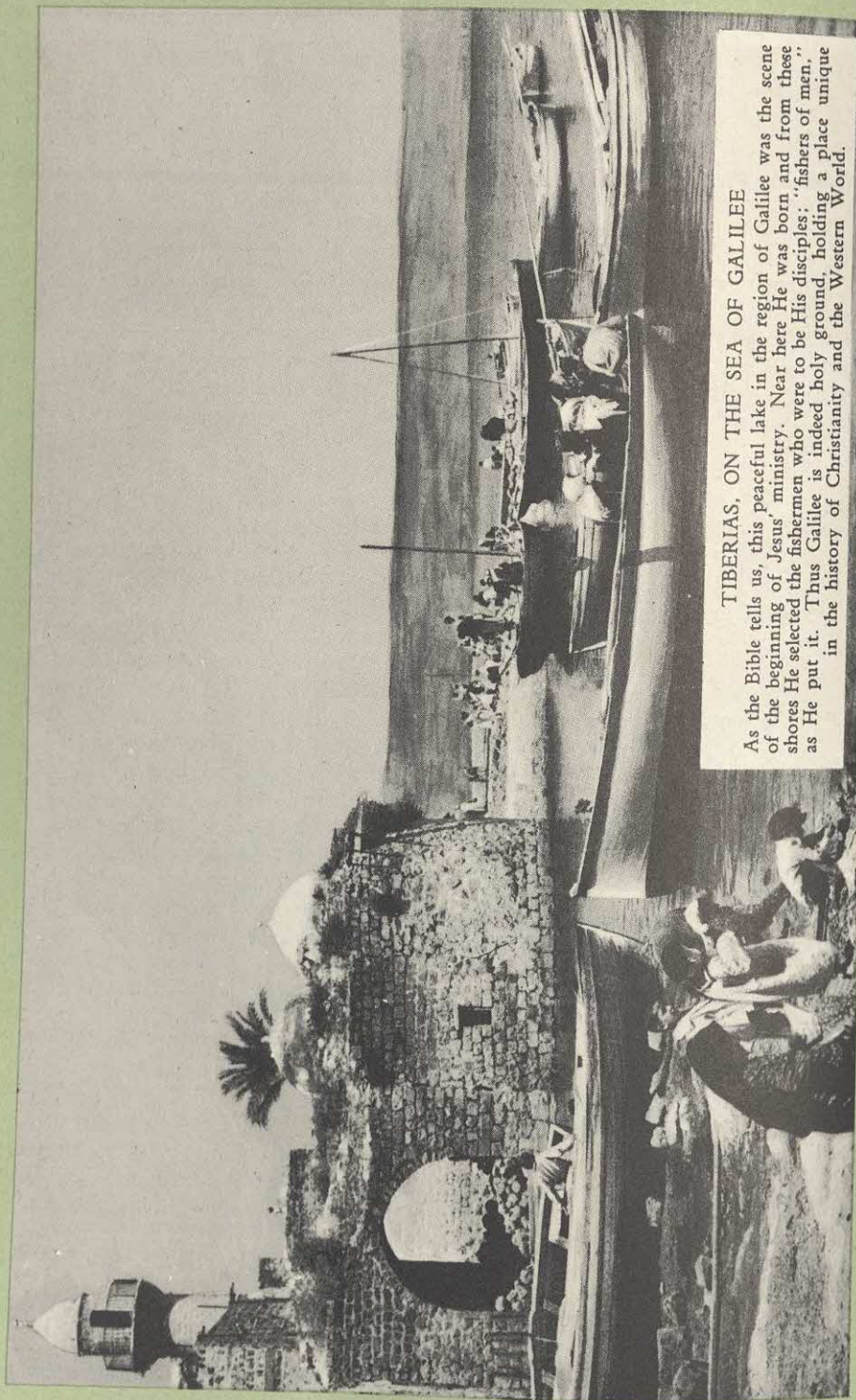
A few years later, Austria took control of West Galicia, which up to that time had been retained by Poland. After 1848, Galicia was in a constant state of upheaval due to the fierce struggle between the Poles and Ruthenians and the rebellion of all the inhabitants against Austrian rule.

With the fall of the Austro-Hungarian Monarchy at the close of World War I, Western Galicia joined the Russian Poles, and Eastern Galicia joined the Ukraine. The entire district was included, in 1923, in the territory of the Republic of Poland.

In the division of Poland in 1939, Russia took Eastern Galicia, and Germany Western Galicia. The defeat of the Reich in 1945 returned Western Galicia to Poland, but Russia, by a treaty establishing the Russo-Polish frontier, kept the eastern section.

GAL'ILEE. A province in the north of Palestine, Galilee has been called the cradle of Christianity, for there it was that Christ spent most of His life. It was hemmed in by the mountains of Samaria on the south, by the Jordan River and the Sea of Galilee on the east, by Phoenicia on the north, and by the Mediterranean on the west. The main occupation of the people of Galilee was fishing. Because they were uncouth and ignorant, the Galileans were held in contempt by the Jews of Jerusalem. Christ preached throughout the country; and the cities of Nain, Capernaum, Cana, and Nazareth are mentioned in the Bible.

GALILEE, SEA OF. Often mentioned in the Bible, the Sea of Galilee lies in the region of Christ's ministry. Although small, only fourteen miles long and six miles wide, this sea has been important since the earliest times. Once there were several thriving towns along its shores, and it was called the Sea of Tiberias after one of the towns. The Jordan River runs through it on its way to the Dead Sea. Although the Sea of Galilee is about 680 feet below sea level, it is approximately 600 feet higher



TIBERIAS, ON THE SEA OF GALILEE

As the Bible tells us, this peaceful lake in the region of Galilee was the scene of the beginning of Jesus' ministry. Near here He was born and from these shores He selected the fishermen who were to be His disciples: "fishers of men," as He put it. Thus Galilee is indeed holy ground, holding a place unique in the history of Christianity and the Western World.



A SCIENTIFIC ADVENTURER

Founder of modern scientific methods, inventor of the first practical telescope, and the genius who discovered many of the principles of physics and astronomy. He formulated the laws of the pendulum, and applied them to measurement of time. Galileo was once tried for heresy, forced to renounce his theories. The scientific pioneer once expounded his ideas to John Milton (above).



than the Dead Sea. Power plants have been built near the Sea of Galilee to take advantage of this great drop in the Jordan River, and they furnish electric power to the surrounding region.

GALILEO (GALILEO GALILEI) 1564-1642). Modern science, with its well-equipped laboratories, its intricate and valuable instruments, and increasing resources, owes much to Galileo, who pioneered in the search for truth. No field of learning was too sacred for him to investigate; no laws or foolish superstitions were too great to keep him from his work. He faced a world that clung to ignorance, and showed it that courage was not wholly confined to

the battlefield. With him began a new era of experimental science.

Born in Pisa, Italy, and educated at its university, Galileo came onto the stage at the height of the Renaissance. It was a time when men were entering upon a period of exploration and research. But advanced though they were in art and literature, men were still living in the dark ages of science.

In 1581, while a student at the University of Pisa, Galileo first attracted notice when he set forth the laws regarding the movement of a pendulum. Standing in the cathedral of Pisa one day, he observed a chandelier swinging back and forth. From that observation he experimented, and gave

the world the principle of the oscillations of the pendulum. When he was twenty-two, he elaborated on the experiments of ancient Archimedes, and invented a hydrostatic balance. Becoming professor of mathematics and natural science at the university in 1589, he continued his experiments, the most important of which were those pertaining to falling bodies. He arrived at the laws of falling bodies by dropping objects of unequal weight simultaneously from the top of the Leaning Tower of Pisa. See FALLING BODIES.

From 1592 until 1610, Galileo was lecturer on mathematics at the University of Padua, and was afterward official mathematician to the Grand Duke of Tuscany, in Florence. During those years he made many important discoveries. He improved the thermometer, experimented with magnets, discovered four satellites surrounding Jupiter, and made observations of the planet Saturn, whose rings were later seen clearly through improved telescopes. He was the first to observe the movement of sun spots, and he found that the sun revolves on its axis and that the axis is inclined.

The people of Galileo's day generally did not believe that the earth moves. It was thought that the earth stood still and that the sun, the moon, and all the planets revolved around it. Galileo, after a sojourn in Florence and Rome, wrote a treatise attacking this theory and stated his belief that the sun is the center and that the earth revolves around it. This belief was considered heresy by Pope Urban VIII and his court, and in 1632 Galileo was forced to admit publicly that his statements were not true. But he always secretly believed in his theory, and never swerved. The world came to agree with him when he was dead. The tomb of the great scientist is in the Cathedral of Santa Croce, Florence.

GALL, gawl, BLADDER. One of the important units in the digestive system is the gall bladder, a storehouse for the bile which is secreted continually by the liver. It is a small pear-shaped sac attached to the

underside of the liver. In the digestive process, as soon as food leaves the stomach and enters the first part of the small intestine, or duodenum, reflex action also forces the bile into it from the gall bladder. The bile plays an important part in the further digestion of the food.

Occasionally hard masses, known as gall stones, will form inside the gall bladder. These cause extreme pain in passing through the bile duct into the intestine. A surgical operation is often necessary to correct the trouble.

GAL'LEY. The blue expanse of the Mediterranean Sea has seen many strange ships since man first ventured from the safety of the shore. One of the early types was the galley, a ship that brought trade to the Phoenicians, colonies to the Greeks, and conquest to the Romans.

The galley was usually a low vessel, possessing one deck, one or two masts, square sails, and oars which were arranged in single, double, triple, or even more banks, one on top of the other. Slaves or convicts commonly rowed the galleys, keeping stroke to the monotonous beat of a mallet on a block of wood. If they weakened or shirked in their rowing, they were whipped by an officer who stood over them. Large galleys sometimes were 100 to 200 feet long and had two men to each oar. The Greek war galleys, called *triremes*, because they usually had three banks of oars, had two rams in the bow, one above the water line and another below, for combat purposes.

Galleys were used until the Middle Ages, when men found out how to navigate with sails against the wind. See BOAT.

GALLIPOLI, gal ip' o le (Turkish, GELIBOLU). The scene of one of the most bitterly fought battles of World War I, Gallipoli is a long peninsula that extends into the Aegean Sea and forms the European side of the Dardanelles. In the middle of the peninsula, on the eastern side, is the town of Gallipoli, with a population of 25,000. This town is in the Turkish province of Adrianople. The high, rugged hills of

the peninsula guard the Dardanelles, the gateway to Constantinople.

Through the ages of history Gallipoli has been the scene of mass movements of people and many military operations. When the Turks entered Europe in 1357, they used it as a line of march, and during the Crimean War, the allied forces landed there in 1854. Again in 1916, the Turks defeated the Entente Allies at Gallipoli, after many months of fierce warfare in an attempt to capture the Dardanelles and force a passage to Constantinople. See **DARDANELLES**.

GAL'LON. A standard unit for measuring liquids in the United States is the gallon. It has a volume of 231 cubic inches, which is equal to the volume of a cylinder seven inches in diameter and six inches high. It equals 3.7853 liters. The *imperial gallon* of England is equal to about five quarts (277.42 cubic inches). There are four quarts, or eight pints, or thirty-two gills in a standard gallon. See **WEIGHTS AND MEASURES**.

GALS'WORTHY, JOHN (1867-1933). Literature of the twentieth century has been profoundly affected by the contributions of John Galsworthy, whose plays and novels are outstanding among modern writings. Originally a lawyer, Galsworthy forsook the bar for writing when a young man. The world first knew him through his strong, forceful plays—*Strife*, *Justice*, and others—which not only called attention to his literary ability, but were realistic documents reflecting the social injustice of his time.

Transferring his talents to the field of the novel, he achieved the highest success in 1922 with the publication of *The Forsyte Saga*, a trilogy of an English family. This was followed by another trilogy of the Forsytes, which was finished in 1928. Later, he wrote *Maid in Waiting*, *Flowering Wilderness*, and *One More River*, and one year before his death he was honored with the award of the Nobel Prize for Literature. His novels are notable for powerful characterization and a remarkable perfection of

style. Three of his well-known plays include *Old English*, *Joy*, and *The Silver Box*.

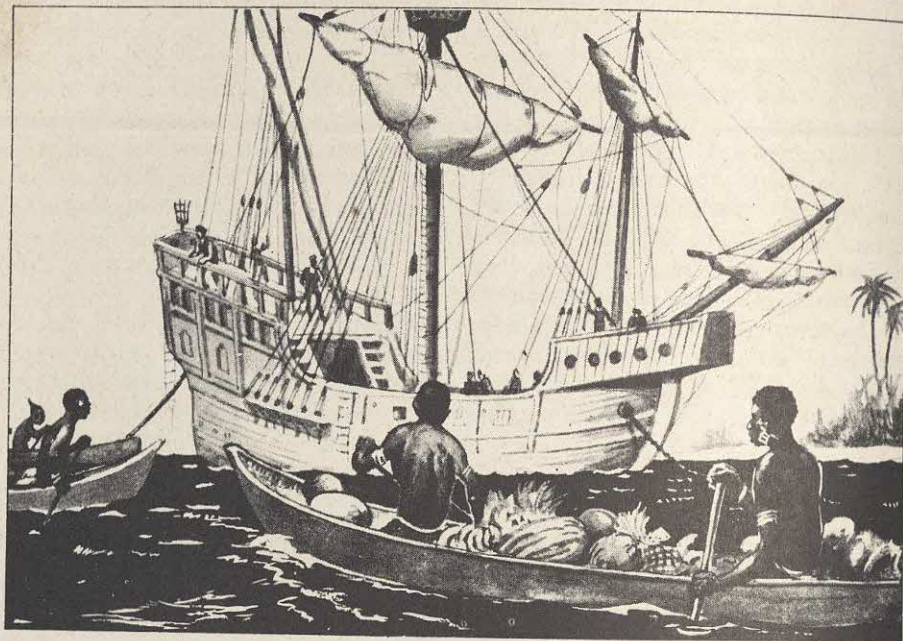
GALTON, *gawl'tun*, SIR FRANCIS (1822-1911). Famous for his studies in heredity, Sir Francis Galton, cousin of Charles Darwin, is recognized as one of England's outstanding scientists. He was born near Birmingham and received his education at King's College, London, and at Trinity College, Cambridge.

Galton traveled extensively in Africa and wrote a treatise on the topography of Southwest Africa. Among his other important works was *Meteorographica*, studies in meteorology that still provide a basis for predicting weather changes.

In his studies in heredity, Galton strove to discover the laws which govern the inheritance of physical and mental traits, and laid the foundation for the science which deals with improving inherited traits. This new science was named *eugenics*, meaning *well born*.

GALVANIZED IRON. When iron articles like eaves' troughs, pails, and farm implements are coated with zinc by being dipped into melted zinc, galvanized iron is produced. Zinc corrodes but very slightly in air and hence protects the iron from rusting. Galvanized iron is largely employed in the form of sheets, often corrugated, for cisterns, sheds, and roofs. As wire it is used by telegraph and telephone companies as a conductor of electricity. Wire netting and certain household utensils are made from it. Galvanized nails last much longer than the common wire nails. Galvanized iron resists the action of air better than tinned iron. Its use is not to be recommended, however, where it is to be exposed to smoke containing sulphurous compounds, nor where chemicals that attack and dissolve zinc might come in contact with it.

Galvanized iron was made as early as 1742. The process of making it usually consists in removing the rust by immersing the iron in dilute hydrochloric or sulphuric acid (a process known as *pickling*), then washing off the acid with water, scouring



A PORTUGUESE CARAVEL COMPLETES AN HISTORIC VOYAGE

The ship of Vasco da Gama in India, after making a hazardous trip around Africa.

the iron with sand, and again washing it. The iron is then plunged into molten zinc and passed through rollers, which aid in giving a smooth surface to the product.

GALVANOMETER. When it is necessary to measure the strength of small electric currents, an instrument called the *galvanometer* is used. There are several types of galvanometers, which work on the principle that an electric current creates a magnetic field about its conductor.

Currents sent through the coil of a common type cause the moving part of the instrument to swing to the right or the left, depending upon the direction of the current. The power of the current is estimated by the number of degrees the needle or coil is forced to swing out of line.

GAMA, *gah'mah*, VASCO DA (about 1460-1524). A sea route to India! This was the prize Columbus sought, but the honor went to Vasco da Gama, whose caravel carried the flag of Portugal. Da Gama, who came of a noble Portuguese family, went to sea

when a boy; and during that age of navigation and exploration, he heard the call of faraway lands. In 1497, five years after Columbus' first voyage, the king of Portugal commissioned Da Gama to explore a route to India by way of the Cape of Good Hope, which Bartholomew Dias had rounded several years earlier. He made the voyage, reached India, and returned to tell of the marvelous riches of the land. Given the rank of a noble, Da Gama returned to India and later, in the year of his death, became its viceroy.

GAMBIA, *gam' bih-uh*. Extending inland for two hundred miles from the great bulge on the west coast of Africa is the British crown colony and protectorate of Gambia. The colony, at the coast, has an area of only 69 square miles, but the protectorate, spreading along the valley of the Gambia River, covers over 4,000 square miles. To the north, south, and east of Gambia is French Senegal.

The British began to take control of the



A "MIXED BAG"

Hunting wild game is a sport beloved of king and commoner. It calls forth all the craft a man can muster to match the keen senses of creatures of the wild. Two such bronzed beauties as these bass, or a brace of grouse (left), represent far more than added viands for the table. Above, a prized trophy.

region early in the 1800's. Its products include peanuts and palm kernels, hides and skins, and beeswax. The population is about 250,000, and Bathurst is the capital and chief port.

GAME. Wild animals, wild birds, and some fish are commonly referred to as game. More exactly, game includes those animals, fowls, and fish that are hunted for sport and which require considerable skill to catch, as distinguished from fish, meat, and poultry. Wild game is usually classified as *big* or *small* game. The most exciting hunting to be found in the world is the big-game hunting of Africa and Asia, where lions, tigers, elephants, leopards, panthers, and alligators test a hunter's skill and courage. None of these animals is used as food, however. Big-game hunting in the United States and Canada, although fully as exciting, is not so dangerous. In these countries, moose, bears, antelope, deer, mountain goats, and mountain sheep are the chief targets of the hunters.

Small game is more plentiful, for besides

rabbits, squirrels, and hares, innumerable birds are to be found. Among the birds are the grouse, quail, partridge, plover, woodcock, snipe, rail, and curlew. In addition, wild geese, swans, and ducks (commonly called wild fowl) attract the hunter when the migration season arrives. Most common of the wild ducks are the canvas-back, teal, redhead, mallard, wood duck, and pintail.

Why Game Laws Are Necessary. Ever since very early times, game laws have been necessary to prevent types of game from being wiped out. Now, regulation of the sport is brought about by requiring every hunter or fisherman to purchase a license. Game laws not only regulate the number of animals or fish that may be caught, but set open seasons when hunting and fishing are legal and closed seasons when game may not be caught. Similar laws protect game against trappers. Game laws vary in every state, depending upon the locality and the kind of game found there. To enforce such laws, game wardens are employed to spend

their full time checking up on over-ambitious hunters and fishermen. Violation of game laws makes one liable to fine or imprisonment or both; so careful sportsmen always study the laws thoroughly before the season begins.

Among the important Federal laws in the United States is the Lacey Act, made up of statutes regulating interstate commerce in game and the importation of birds and mammals from foreign countries. Other laws protect the birds and their eggs on Federal bird reservations. One of the most interesting of these laws is the Migratory Bird Act of 1918, which provides for agreements between the United States and Canada to protect the game birds that migrate back and forth between the two countries. A migratory bird treaty with Mexico was later put into effect.

Game laws also protect the fish and game of Canada. Game regulation there is handled by the Minister of the Interior. As in the United States, every province has game laws, most of which are strictly enforced.

Game Preserves. Game preserves maintained by the United States total thousands of square miles and include areas in Alaska, Puerto Rico, and Hawaii. These preserves are really refuges for wild life of all kinds. In addition to these Federal preserves, the states have set aside hundreds of refuges, which have a total area of millions of acres. The largest American game preserve is Yellowstone National Park, an area of over 3,400 square miles.

Canada, likewise, has set aside vast areas as game preserves for the protection of wild game.

Game and bird preserves are usually patrolled by game wardens to protect the game from other animals and birds, as well as from hunters. Some of these areas are not patrolled, but are posted with signs warning the hunter of his trespassing. In the United States, game preserves are under the supervision of the Bureau of Biological Survey, the Forest Service, Bureau of Fisheries and the National Park Service.

The animals most protected by the gov-

ernment are the buffalo, elk, moose, deer, and antelope. Various land and water game birds also receive protection in both Canada and the United States. See CONSERVATION.

GANDHI, *gahn'de*, MOHANDAS KARAMCHAND (1869-1948). Leader of the movement for Home Rule in India, "Mahatma" Gandhi was the outstanding twentieth-century figure produced by that teeming, wealthy land. Devoted to the betterment of India's lower castes, Gandhi presented a striking figure in world affairs with his strange white robe and frequent fasts, and proved to be a greater force than any army in molding India's destiny.

A member of a family of traders in Porbander, Western India, Gandhi was married at the age of fourteen and in 1888 went to London to study law. Five years later he was back in India, but left for Africa in the employ of a merchant. He was jailed in Africa as an agitator; but upon his release, he returned to India and in 1914 helped to recruit soldiers for the Indian Army. After the war, he led a "no tax" campaign, which resulted in some violence, and in 1922 he was jailed again for conspiracy against the government. Released, he continued his efforts for reform in India's government. He campaigned especially to win political representation for the "untouchable" caste.

In 1939, at the outbreak of World War II, Gandhi presented the demand of the All-India Congress for immediate consideration of India's independence, but the British government could not guarantee independence while the war was in progress. Gandhi was imprisoned from August, 1942, until March, 1944, to forestall a civil-disobedience campaign for immediate independence. After the British agreed to free India after the war, Gandhi worked to achieve a united country; and in 1948, after the partitioning of India, he strove, by fasting and preaching, to end the warfare that broke out between the Hindus and the Moslems. He was assassinated in January, 1948, by a Hindu fanatic opposed to his communal policy. See INDIA.

A poor and devout man, Gandhi was given the title of "Mahatma" (Great Souled) by his devoted followers, although he himself did not desire the title and had asked that it be dropped. The most important of his writings was *An Experiment in Truth*, an autobiography.

GANGES, gan'jeez. To devout Hindus, the Ganges is a sacred river. For they believe that its waters, twisting through Northern India for a distance of 1,557 miles, have healing powers and also guarantee an afterlife in Paradise when death occurs. Accordingly, Hindus seek its banks when they feel their end approaching, drink its waters, and then wait for death to come. Should they die in Benares, holy city along its shores, they feel that they are doubly blessed.

Important as the Ganges is to death, it is even more important to life, for it waters a valley almost unequalled for fertility. Here are grown cotton, rice, fruit, opium, indigo, grains, and sugar. In addition, it comprises a main artery for transportation into the heart of India.

With its source high in the lofty Himalayas, the Ganges flows south and southeast through the United Provinces, then east, and finally southeast through Bengal, where it empties into the Bay of Bengal. Its delta, 200 miles long and about as wide, contains the important city of Calcutta.

GAN'NET. Belonging to the same family as the *booby* of the southern seacoasts, the gannet is a large bird of the North Atlantic. It is about three feet in length, with long wings and tail which aid in its powerful flight and in its skillful diving from the air for fish. Its general color is whitish; its head and neck are of buff color. The beak, which is long and conical, is very strong.

The presence of flocks of gannets over the sea is a sign that schools of fish are swimming just below, and fishermen have

The North American gar pike is detested by sportsmen because of the tremendous toll he takes of valuable game and food fishes.



FISH-EATING BIRD—THE GANNET

learned to know this and to turn the knowledge to good account. In the spring, gannets seek islands on both sides of the North Atlantic, build crude nests of seaweed on the cliffs, and lay in each a single bluish-white egg. Their number is steadily diminishing because of the gathering of their eggs and young.

GAR. There are two kinds of gar fish, and although they look alike, one is found only in salt water and the other in fresh water. The salt-water gar is found in all parts of the ocean where the water is warm. It is round and thin, and its jaws project to a point, forming a strong bill. It sometimes grows to a length of five feet and feeds upon small fish. The fresh-water variety, found in the waters of the United States, is covered with armor-like scales; and its long, round body terminates in a lengthy snout in which are set rows of sharp teeth. The largest of the fresh-watergars are found in southern waters.



GARDE'NIA. The delightful fragrance, color, and shape of the gardenia make it one of the most popular florists' flowers, always in demand for a corsage or to be worn on the coat. Resembling and often confused with the camellia, it is daintier and more fragrant than that blossom (see *CAMELLIA*). Gardenias are of a delicate lemon-white color and have the form of a salver or funnel. The so-called *Cape jasmine*, now popular in America, is a species of gardenia native to China. The genus name, *Gardenia*, was applied to the group by Linnaeus, who wished to honor Dr. Alexander Garden of Charleston, S. C.

GARDEN OF THE GODS. Lying about five miles northwest of Colorado Springs, Colo., in the Rockies, is one of Nature's greatest pranks, the Garden of the Gods. With its gigantic area of some 500 acres of scenic rocky grandeur, this spot has come to be a mecca for tourists. The softer parts of the colored sandstone have been worn away by countless years of winds and rains, and many curious and grotesque forms have resulted. Famous among these natural statues are the *Cathedral Spires*, the *Balanced Rock*, and the *Seal and the Bear*. The gateway to the Garden is formed by two towering masses of red sandstone, more than 300 feet high and just wide enough apart to allow a roadway between.

GARFIELD, JAMES ABRAM (1831-1881). A capable and scholarly man, who with untiring effort, climbed by slow degrees from

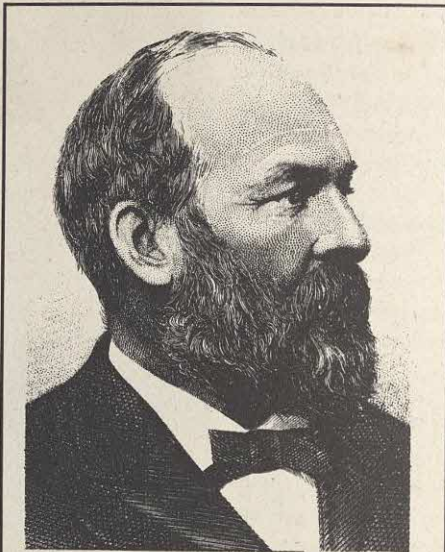
a driver of horses on the Ohio Canal to the Presidency of the United States, James A. Garfield was the second American President to face the assassin's gun. The long road to the White House was marked by

many accomplishments and evidences of outstanding character. Only sixteen years before his own death, he had quieted an angry mob in New York after the assassination of President Lincoln. As the twentieth President, Garfield of course left no record of achievements in his administration of only four months; but the possibilities of what he might have done, based on his fine record up to the time of his election, have often formed a basis for speculative thought.

Early Life. A year after James's birth, which occurred in Orange, Ohio, on No-

vember 19, 1831, his father died, leaving a wife and four children. Young Garfield early contributed to the support of the family by working on farms and driving a team on the towpath of the Ohio Canal. He managed to attend school and at eighteen went to Chester, Ohio, entering Geauga Seminary. He later went to the college at Hiram, Ohio, and finally graduated from Williams College at Williamstown, Mass., in 1856, at the age of twenty-five. The following year, while studying law, Garfield became president of the college at Hiram, and occasionally preached at a near-by church.

Career in Politics. Garfield's career in politics began with an election to the state



JAMES A. GARFIELD

Twentieth President of the United States Administration, March, 1881-Sept. 1881. A brilliant career as a military man, teacher, and lawyer, as well as his capable handling of his first problems as Chief Executive, promised much for Garfield's administration.

senate in 1859. Shortly afterward, however, at the outbreak of the Civil War, he was placed in command of a volunteer regiment. After the Battle of Middle Creek, on January 10, 1862, he was commissioned brigadier general, and for his bravery at Chickamauga, the rank of major general was awarded. In 1863 the young soldier, having been elected to Congress, resigned from the army. For seventeen years he served as a Representative, and eventually became the leader of the Republican party in the House.

In 1880 Garfield was elected to the United States Senate, and later was nominated for President as a "dark horse" among the supporters of Grant and Blaine. He was one of the first candidates to deliver campaign speeches in his own behalf, and decisively defeated his Democrat opponent, General Winfield S. Hancock. At this time, the Republican party was split into two factions and, much as he tried, Garfield was unable to reconcile them. However, he did win a moral victory over one group, when his appointment of a customs collector was confirmed by the Senate over the opposition of the "stalwart" faction, led by Roscoe Conkling of New York.

The Assassination. It was a rather happy and confident man who entered the Washington railway station on July 2, 1881, en route to Williams College for a class reunion. A few minutes later a shot rang out and Garfield was carried out, the victim of Charles Guiteau's anger because he had not received a coveted office. Two months later, Garfield died of the wound, and was buried in Cleveland, Ohio, where a large tomb has been erected to his memory. Vice-President Chester A. Arthur completed the term of office.

GARGOYLE, *gahr'goil*. The fantastically ugly faces which are carved into the stone waterspouts of many medieval cathedrals are called gargoyles. These bits of "statuary" serve to ornament an otherwise uninteresting necessity at the roof corners of the buildings. Their ugliness is probably due to ancient superstitions that such mon-



CHAMPION OF ITALIAN LIBERTY
Garibaldi aided in the unification of Italy.

strosities would frighten evil spirits away from the sacred building. The most famous gargoyles are on Notre Dame Cathedral in Paris. See NOTRE DAME, CATHEDRAL OF.

GARIBALDI, *gah re bahl'de*, GIUSEPPE (1807-1882). Warrior, liberator, and lover of freedom, Giuseppe Garibaldi is honored as the father of modern Italy. It was through his efforts that Lombardy was united with Sardinia, Piedmont, Genoa, lower Italy, and Sicily to form one united nation under Victor Emmanuel.

Garibaldi, the son of a merchant captain of Nice, which was then a part of Sardinia, went to sea when he was fifteen, and before long was placed in command of a ship. Joining the Young Italy movement led by Giuseppe Mazzini, he took part in an uprising in 1834 and was condemned to death. He escaped to Marseille, however, and two years later went to South America. There he assisted the state of Rio Grande do Sul in its revolt against Brazil, and then fought in the civil wars of Uruguay.

In 1848 Garibaldi returned home, where a revolution against Austrian rule in Northern Italy had taken place. Failing in the attempt to gain freedom for his country, he settled on a small farm on an island in the Mediterranean.



GARIBALDI PAYS HOMAGE TO VICTOR EMMANUEL AS KING OF ITALY

This famous patriot believed that the unification of Italy could be realized only under a constitutional monarch, and so gave his allegiance to Victor Emmanuel of Sardinia.

Eleven years later, Garibaldi led the revolt in Lombardy and helped recover that territory for Sardinia and Piedmont, of which Victor Emmanuel was king. Then, in 1860, when lower Italy and Sicily revolted against the rule of Naples, he led a successful attack against the king of Naples, becoming dictator of the Two Sicilies. Garibaldi then had the opportunity of ruling this large territory for himself, but, instead, he united it with the other lands. Thus was formed the kingdom of Italy under Victor Emmanuel II.

Not content to spend the rest of his days in honored retirement, Garibaldi joined the French in their war with Prussia, and upon the end of the struggle, was elected to the French Assembly. He resigned later, however, and returned to his home in Sardinia. In 1875 he became a member of the Italian Parliament. See ITALY; VICTOR EMMANUEL II.

GARLAND, HAMLIN (1860-1940). Taking the picturesque life of the West for his

theme, Hamlin Garland was the author of many well known novels and short stories. He was born at West Salem, Wis. His literary career began in 1884. Some of his books include *Main-Traveled Roads*, *The Long Trail*, *The Tyranny of the Dark*, *A Son of the Middle Border*, *Roadside Meetings*, *The Shadow World*, *Captain of the Gray Horse Troop*, *The Eagle's Heart*, and *The Rose of Dutcher's Coolly*.

Garland also wrote a biography of Ulysses S. Grant, a volume of critical essays, and a number of poems.

GAR'LIC. French chefs value this perennial bulb plant as a seasoning, and southern Europeans are particularly fond of its flavor and aroma. It belongs to the same family as the onion and the leek but is more strongly flavored than either of these. The peoples of southern Europe use garlic daily to flavor their soups, stews, and salads, and to some extent they serve it as a side vegetable dish, but it has never become popular with Americans.

The bulb of this plant is made up of a dozen or more small bulbs called *cloves*, and propagation is usually by the cloves, which are planted like onion sets. Planting is done in early spring and the same care given as in onion culture. In the fall, when the tops die, the bulbs are taken up, the leaves braided to hold the cloves together, and the clusters hung in a dry, airy place for winter use.

A touch of garlic seasoning is often desirable. Rubbing the inside of the salad bowl with a piece of clove of garlic is sufficient to flavor a salad. Some cooks think it improves the roast to sprinkle a very small quantity of chopped garlic on the meat just before it goes into the oven. See ONION.

GAR'NER, JOHN NANCE (1868-). As a climax to his successful career in law and government, John Nance Garner was elected Vice-President of the United States in 1932, and, along with President Franklin D. Roosevelt, was re-elected in 1936. He was born in Red River County, in Texas. After years of poverty, in which he worked as a cowboy, newspaperman, and law student, he was admitted to the Texas bar in 1890. He rose rapidly in his profession, and in 1898 was elected to the Texas legislature, where he served for four years.

Garner was elected to the House of Representatives of the United States in 1903. For thirty years he served as a member of Congress, and in 1931 was elected Speaker of the House. Noted for his independent views and his effectiveness in debate, Garner was the choice of many people as the Democratic nominee for President in 1932. At the national convention in Chicago, however, he was given the Vice-Presidential nomination. Popular as a Congressman and as presiding officer in the Senate, Garner displayed great resource and tact in both capacities.

GAR'NET. Bohemia, Ceylon, and South Africa produce the world's garnets of gem quality. Garnet is silicate of alumina, a rather common natural mineral about as hard as quartz. Various elements in combination with it account for the difference

in the coloring of varieties of garnet.

It varies from its most common color, dark brownish red, to almost black, and is less frequently found in clear or various shades of green, yellow, and red. *Almandine* and *pyrope*, or "Cape ruby," from the African diamond fields, are beautiful red varieties used as gems. The green garnet is known as *Uralian emerald*.

Garnet is common in schistose rocks—those that have been altered by great heat or pressure, or both—and about the borders of igneous rocks. It is used chiefly as an abrasive—red "sandpaper" is crushed garnet—and for watch jewels. The hardness of garnet is from 6.5 to 7.5. See ABRASIVES.

GAR'RISON, WILLIAM LLOYD (1805-1879). "I shall strenuously contend for the immediate enfranchisement of our slave population. . . . I will not equivocate—I will not excuse—I will not retreat a single inch—and I will be heard."

With this ringing declaration, William Lloyd Garrison started the publication of *The Liberator* in Boston in 1831, and thereby began the anti-slavery movement that was to end in the Civil War.

Beginning in 1827 as an editor of the *National Philanthropist*, a temperance newspaper, Garrison later became assistant to Benjamin Lundy in the publication of a paper called *The Genius of Universal Emancipation*. Garrison spared no words in his attacks on slavery and the slave trade, and finally was sent to prison for libel. When he was released, he started *The Liberator* in Boston, and in the same year, 1831, formed the New England Anti-slavery Society. Later he organized the American Anti-slavery Society, of which he was president for many years.

Garrison was often threatened with death because of his violent articles, and once, in 1835, was almost killed by a mob in Boston. He continued the paper and the society, however, until the end of the Civil War, when there was no longer any need for them. Historians agree that Garrison was one of the most influential of the abolitionists who aroused the North.

GARTER SNAKE. The garter snake of the East and the garter snake of the West and their close relatives, the ribbon snake and other kinds of garter snakes, are harmless creatures familiar to children. The common garter snake is found through the greater part of North America, Mexico, and Central America. It is also found in the Eastern Hemisphere.

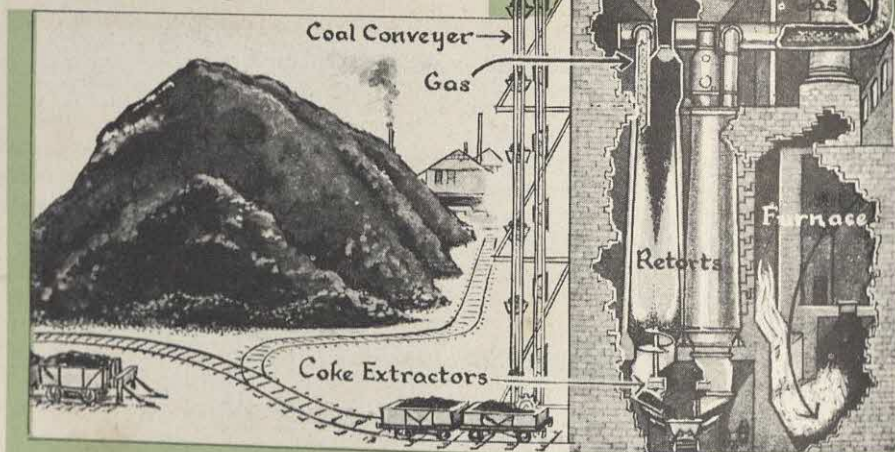
The common garter snake is usually brown, olive, or black above, with lighter

sides and a light line down the center of the back. Beneath, it is greenish white or yellow.

The food of a garter snake is largely earthworms and small frogs. In the fall, with others of its kind, it spends much of its time sunning on rock piles. About the time of the first severe frost, the snake and its "sun-parlor" companions go into winter quarters, where they hibernate until the warm suns of spring call them forth.

MANUFACTURING "LIGHT"

Illuminating gas is made by the decomposition of coal by heat. The coal is carried on belts to the furnaces or retorts where the gas is driven off. Fans draw the gas out of the retort and send it through the rest of the plant, where the impurities are removed.

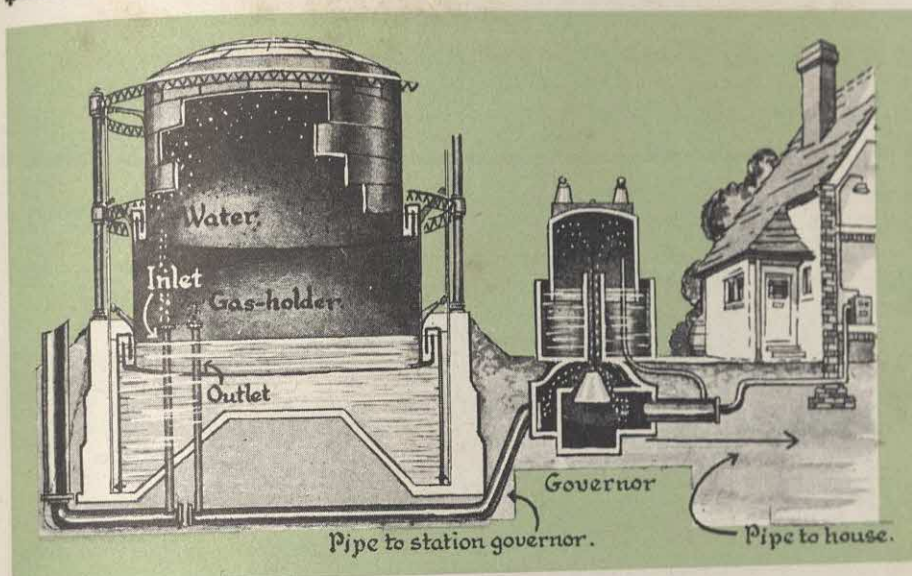


GAS. A substance like air, which has neither size nor shape of its own, is called a gas. Unlike matter in the solid or liquid state, a gas always expands to fill any container, however large, in which it is placed. It may also be greatly compressed into a very small volume. If a gas is sufficiently compressed and also cooled, it may be liquefied (changed to the liquid state). Colorless gases like air are not visible; but gases with color, such as greenish-yellow chlorine, are easily seen. See ATMOSPHERE; BOYLE'S LAW; COMPRESSED AIR; LIQUID AIR; MATTER.

According to the *kinetic molecular the-*

ory of matter, the molecules of a gas are very far apart and in constant rapid motion, with speeds that increase as the temperature increases. This picture of gases accounts for their compressibility and their tendency to expand. It also shows that the pressure of a gas on any surface is due to the ceaseless impacts of the molecules against that surface. See AVOGADRO'S LAW; BALLOON; BOYLE'S LAW; HEAT.

As the temperature of a gas rises, its molecules become more energetic and push harder against restraint. Hence a heated gas expands, if possible, or its pressure increases if it cannot expand. Accurate



HOW GAS REACHES THE CONSUMER

Gas is stored in great tanks and sent to the consumer through long networks of mains. A governor between the main lines and the consumer regulates the pressure.

temperatures are determined from measurements of pressure of a fixed volume of hydrogen in a standard gas thermometer.

If ammonia, chlorine, or another odorous gas is released, its molecules *diffuse* through the air and are noticeable, after a time, in every part of the room. The gas is spread more rapidly by air currents, however, than by diffusion alone. The diffusion of a fumigating gas through a room or a building is used to destroy vermin or insects. Gases also diffuse through porous solids.

Gases can be absorbed by (dissolved in) liquids and porous solids. Thus carbonated beverages are liquids that have absorbed carbon dioxide under pressure, and household ammonia is water that has absorbed gaseous ammonia. Fish get their oxygen supply from the air dissolved in water. In laboratories charcoal is used to produce a high vacuum by the absorption of gases. Charcoal is also used in gas masks. See **Absorption**.

Many gases are *combustible*; that is, they can be burned. As a result, we have a number of important fuels, including natural

gas; gas made from coal; acetylene; and gasoline and kerosene gas in kitchen stoves and heaters. Also, as a result, we have to be careful to avoid flame or heat where gases are not under control. See **Diffusion**; **Expansion**; **Heating and Ventilation**; **Oxygen** (color picture).

GAS, ILLUMINATING. William Murdoch introduced gas for lighting in English cotton mills in 1805. Illuminating gases are now widely used as fuel both in homes and factories. They are gases manufactured in most cases from bituminous coal and petroleum. A similar gas is made from wood, rosin, oils, and fats.

All illuminating gas is asphyxiating, and extreme care must be taken in using it to see that all burners when not lighted are tightly closed. See **Heating and Ventilation**.

GAS, NATURAL. From the depths of the earth comes natural gas, a highly combustible, mechanical mixture of hydro-carbons, varying somewhat in composition according to the different localities where it is found.

Natural gas is secured from natural reser-



CAPPING A NATURAL-GAS WELL

After a well has been drilled, it is capped and held under tremendous pressures. The gas is then sent through long pipe lines to city stations many miles away.

voirs by drilling through the various strata of sand, gravel, slate, and limestone into the gas-bearing stratum. This stratum is usually more than one half mile below the surface of the earth. The hole is drilled by machinery and cased up with a tubing which keeps water and quicksand from flowing in to retard the flow of gas. This tubing or casing extends into the solid rock and also serves as a means of confining the gas.

If gas does not appear when the stratum is reached, a heavy charge of nitroglycerine is exploded in the bottom of the well. This explosion breaks large fissures outward from the well and permits gas to flow into the well and to the surface. Since the gas is often confined in the earth under great pressure, it rushes to the surface with tremendous force.

To reduce the size of pipe required, the gas is usually compressed when piped through transmission lines to towns and cities where it is consumed. Regulators reduce the pressure finally to about four ounces per square inch when the gas is used for cooking, heating, and lighting purposes.

Natural gas contains about fifty more heat units per cubic foot of volume than artificial illuminating gas. While it does not cause asphyxia (suffocation) so quickly as coal gas, it should be handled cautiously. It is very explosive when mixed with air.

Natural gas has been extensively used in cities for domestic purposes, such as heating, cooking, and illuminating, and in the manufacture of glass. It also makes a desirable fuel for internal-combustion engines.

In the United States, Texas, California, Ohio, Louisiana, Pennsylvania, Oklahoma, Kansas, and New York have been leading producers of natural gas.

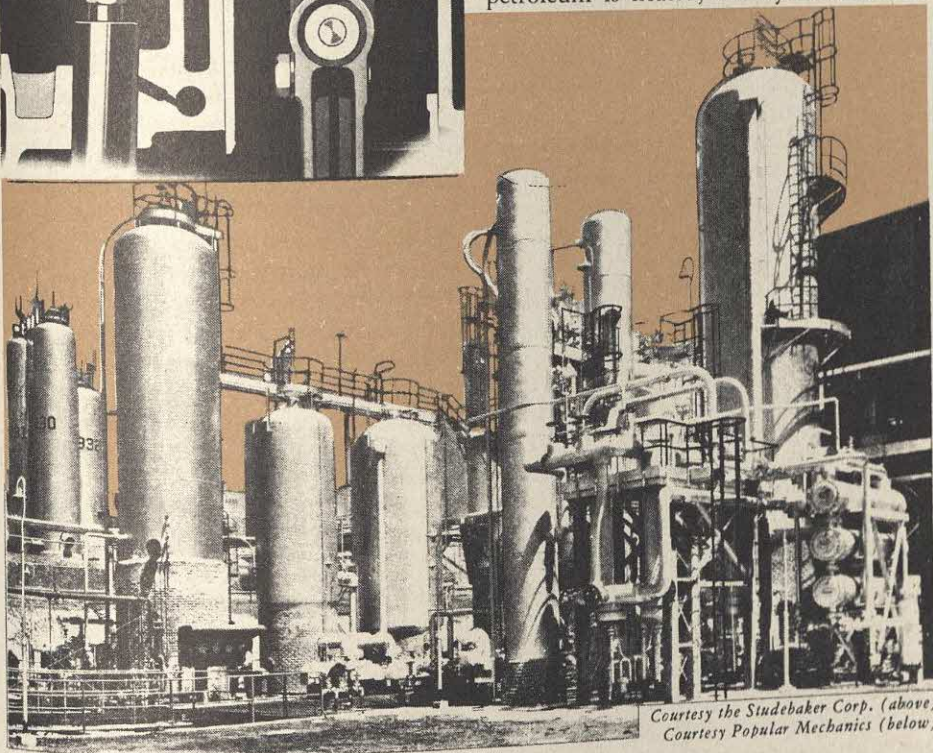
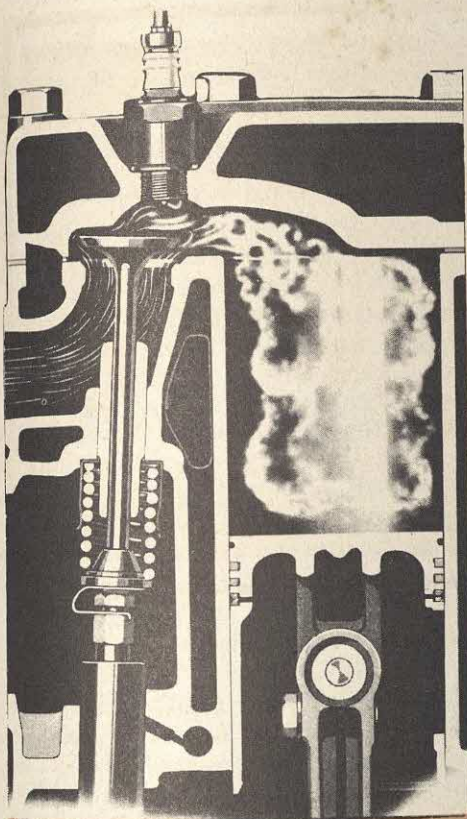
GAS, POISON. See **POISON GAS**.

GAS ENGINE. Modern transportation and power owe much to the invention of the gas engine. Automobiles, airplanes, trucks, tractors, power boats, and even small trains are driven by this type of engine. Not only is it used to drive vehicles, but it also furnishes power for pumping water, mixing concrete, sawing wood, separating milk, and performing countless other tasks on the farm and in industry. See **AIRPLANE**; **AUTOMOBILE**; **CARBURETOR**;

DIESEL ENGINE; INDUCTION COIL; MAGNETO-ELECTRIC MACHINE.

GASOLINE, *gas' o leen*. Among the most important fuels in the world today is gasoline, chief of the petroleum distillates. Its principal use, of course, is in driving the internal-combustion gas engine, which makes possible our automobiles, airplanes, and tractors. But its economic effect goes further than that, for it has created power to perform various tasks, it has increased leisure time in manifold ways, it has saved costs by doing work faster and better, it has brought about new industries, and, finally, it has made life more pleasant by creating new diversions and recreations.

What Gasoline Is. From petroleum come a number of combustible hydrocarbons which separate into groups according to their specific gravity, boiling point, and volatility (tendency to evaporate). So when petroleum is heated, the hydrocarbons of



*Courtesy the Studebaker Corp. (above)
Courtesy Popular Mechanics (below)*

GASOLINE: FROM BEGINNING TO END

Above is a view of part of a refinery where crude petroleum is "cracked" to make gasoline as well as many other by-products. Top, a cross section of a gasoline-engine combustion chamber.

greatest volatility boil off first, leaving the remainder heavier. As the heat is increased, other compounds are distilled off until only fuel oil is left.

The lightest and most volatile of the well-known compounds is naphtha, followed by benzine, gasoline, kerosene, gas oils, paraffin oils, lubricating oils, and so on down to fuel oil. It will thus be seen that gasoline lies well toward the head of the list in volatility. Because of this fact, it is an excellent fuel for gas engines, stoves, heaters, and lights.

Carefully handled, gasoline is a good servant, but caution must always be exercised in keeping it away from open fires because the fluid vaporizes so readily that its fumes will fill a room in a short time, causing an explosion if an open flame is present. Therefore, to assure safety and to avoid loss by evaporation, gasoline should be stored away from the sunlight, preferably in metal tanks underground.

Gasoline Taxes. So great is the consumption of gasoline in modern countries that many governments collect a tax on each gallon of gasoline sold. The American states and the Canadian provinces all collect gasoline taxes and thereby raise many millions of dollars in revenue each year. Most of the money is used for the construction and upkeep of roads and highways, and thus the people who do the most driving and pay the most taxes get the most benefit. Collection is simple and economical, for the tax is added to the cost of the fuel when bought. The rate of taxation varies widely. See DISTILLATION; NAPHTHA; PETROLEUM; PIPE LINES.

GASTRIC, gas'trik, JUICE. Found in all parts of the stomach except the section around the upper end, gastric juice is one of the digestive fluids of the body. It is secreted by glands embedded in the mucous lining of the stomach. During a meal the gastric juice wells out from the countless invisible mouths of these glands, and is thoroughly mixed with the food as the contents of the stomach are moved to and fro by contraction of the stomach walls.

The colorless gastric juice helps to begin digestion — the process by which food is broken down into materials the walls of the intestine can absorb. After the gastric juice has completed its work, the food is reduced to a creamy mass called *chyme*. In this form it enters the small intestine, where digestion is completed.

The important substances in gastric juice are hydrochloric acid and three ferments, or *enzymes* — pepsin, rennin, and lipase. Pepsin breaks food proteins down into substances known as peptones and proteoses. Rennin aids in the digestion of milk. Lipase begins the chemical breakdown of certain fats. Among other things, hydrochloric acid is necessary to the action of pepsin, and it destroys bacteria that enter the stomach. Gastric juice also contains water and salts. Every twenty-four hours the human stomach secretes two or three pints of the juice.

GATES, HORATIO (1728-1806). The British general, Burgoyne, was defeated at Saratoga (1777) by an army headed by Brigadier General Horatio Gates. That defeat was the turning point of the war.

Although born in Essex County, England, and trained in the English army, Gates joined the colonists at the outbreak of the American Revolution. He had previously lived in Virginia, where he had purchased an estate after leaving the English army. Gates was appointed by Congress to head the American army of the North, but historians give the credit for the Battle of Saratoga to Schuyler, Morgan, and Arnold rather than to Gates.

In 1780 Gates was transferred to the Southern districts, but was brought before a court-martial when he was defeated by General Cornwallis at Camden. Gates was acquitted and restored to command after the surrender of Cornwallis at Yorktown.

GAUL, gawl. The region known to the ancient Romans as Gaul included what is now France, Belgium, parts of Germany, the Netherlands, Switzerland, and Northern Italy in the Alpine region. The inhabitants were Celtic people, concerning whom

little was known until the conquest by Julius Caesar.

Latin students are familiar with the opening lines of Caesar's *Commentaries*, which begin, "All Gaul is divided into three parts." That part nearest to Rome on the east side of the Alps was known as *Cisalpine Gaul*. Later, the land almost corresponding to the area of modern France was called *Transalpine Gaul*. Caesar, as proconsul over the territories next to Gaul, conquered the land over a period of nine years, from 58-50 B. C. Prior to that time, Roman power had been restricted to an area called the Province, bordering the sea from the Alps to the Pyrenees.

About four centuries before Christ, the Gauls under native chieftains had started to push southward, defeating the Romans at Allia in 390 B. C. Continuing their march, they sacked and burned Rome. A century later, the eastern Gauls invaded Macedonia and Greece, moving into Asia Minor, where several tribes settled. These Gauls are remembered to the Western World through Paul's *Epistle to the Galatians*. The Gallic settlements along the banks of the Danube and in the south of Germany failed to survive the onslaughts of the conquerors from the north and east who descended on them.

GAUTAMA, *gou tah'mah*. See **BUDDHA**.

GAY-LUSSAC, *gay lu sah'k'*, **LOUIS JOSEPH** (1778-1850). Although most of us today recognize H_2O as the chemical formula for water, few of us know that it was the French chemist, Gay-Lussac, who first discovered that water is made up of two parts of hydrogen to one part of oxygen. This discovery formed the basis for his announcement of the law of volumes, which is today very important in the study of chemistry. The *law of combining volumes* states that, when gases combine, they combine in very simple proportions by volume. For example, two volumes of hydrogen plus one volume of oxygen combine to form two volumes of steam.

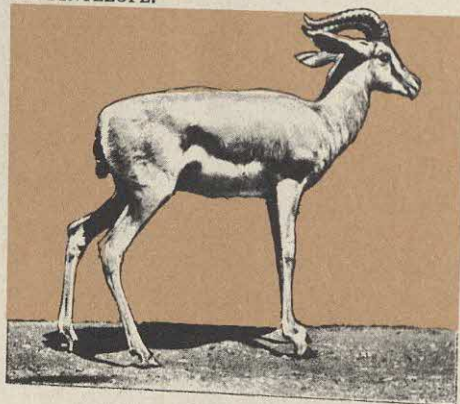
Gay-Lussac's experiments, which greatly increased the practicability of the science



THE GAULS RAID A PROUD CITY
The cackling of sacred geese caged atop the Capitol wall warned Rome of this Gallic assault.

of chemistry, were recognized by the government of France. He received many honors and held both educational and governmental positions. A peerage was granted to him in 1839. See CHEMISTRY; WATER.

GAZELLE, *ga zel'*. The small, graceful gazelle, a member of the antelope family, is found in parts of Asia and Africa. Running in herds, gazelles bound along swiftly and gracefully, hardly seeming to touch the earth. There are about twenty species, and all males and most females have round, black horns about a foot long. The eyes of the gazelle are very large, and are soft and lustrous in appearance. The color of the coat is light fawn on the back and pure white underneath, with wide dark-brown bands flanking the sides. The common gazelle is called the *ariel* or *dorcas*, and is brownish in color. Other species include *Loder's gazelle* and the *chinkara* of India. See ANTELOPE.

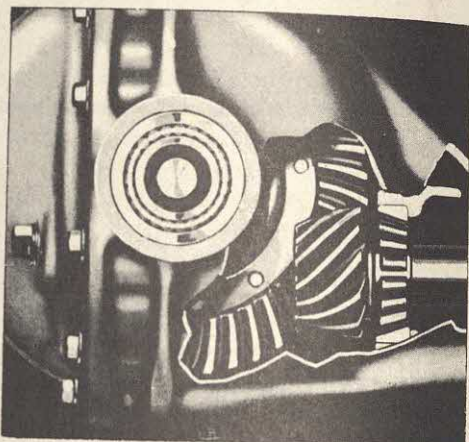


FOREST ATHLETE

Smooth and effortless leaps make the gazelle one of the most graceful of all animals.

GEARING, *geer'ing*. Machine designers use a number of types of toothed and grooved wheels, or gears, to change the direction of rotation of a driven shaft, or the speed or axis of its rotation. Gearing, or *gear trains*, are specially adapted to *short-center* drives; that is, where the axes of driving and driven shafts are close together.

Of the various types of gears used, the



Courtesy the Studebaker Corp.

STEEL TEETH MOVE AUTOMOBILES

Gears transmit motion from one part of a machine to another. This is a cross-section view of the rear-axle gear of an automobile.

spur gear is the most common. It consists of two or more toothed wheels, also called *cogwheels*. The number of revolutions in a given time made by two cogwheels is inversely proportional to the number of teeth on each wheel.

The *bevel* gear is also very common. It consists of two wheels with their axes running in different directions. It changes the speed if the cogwheels are not of the same size, and it may also change the drive from horizontal to vertical, or the reverse, and transmit power around a corner.

The *worm* gear is used where a great change in speed is desired. It consists of a worm, threaded spirally, like a screw, and a cogwheel. For every revolution of the worm, the cogwheel advances only the distance of one tooth. The worm gear is used in the steering mechanism of an automobile. The *variable-speed friction drive* is a type of gearing that transmits motion by sliding contact.

Special gear-tooth designs of great accuracy have been developed to increase the capacity of gearing to transmit power with a minimum of power loss. Many speed reducers, for instance, employ *herringbone* or *helical* gears, which give a large area of tooth contact. See DYNAMICS; MECHANICS.

GECK'O. A member of the lizard family, the gecko prefers the nighttime for its ventures out into the world. Because of sucking pads on his stubby feet, he can walk on ceilings or scamper up perpendicular surfaces. The body is covered with numerous round warts. The gecko is quite common in Northern Africa and Southern Europe.

GEMINI, jem' i ni. A Latin word meaning *twins*, Gemini is the name of the constellation containing the two bright stars, Castor and Pollux. From May 21 to about June 21, the sun is in the constellation of Gemini. As the third sign of the zodiac, the symbol of Gemini is π . See **ZODIAC**.

GEMS, jemz. See **PRECIOUS STONES**.

GEMS, ARTIFICIAL. Many of the glittering diamonds and milky pearls that are seen in the windows of jewelry stores are not precious gems at all, but are only clever imitations. The great value of gems has led to their imitation down through the ages. The ancient Egyptians made imitations of costly gems by coloring pieces of glass. The artificial gems made by the Romans were so perfectly done that it was difficult to distinguish them from stones of real value. In making their imitations, the Romans used powdered rock crystal. In the Middle Ages the alchemists were successful in making excellent imitations of the emerald, sapphire, topaz, and ruby.

In modern times, imitations of valuable gems are produced in several ways, the most common being by the use of glass, known as *paste* or *strass*. The glass used for this purpose contains a large amount of oxide of lead, which makes it very bright and clear; when colored, it can be made to look like the most valuable stones. Imitation diamonds are often made from glass, but they can be easily detected because they are soft and show scratches when tested with hard instruments. Real diamonds will scratch or cut glass. Synthetic diamonds are produced by chemical processes; and although they are successful reproductions, the process is so expensive that manufacture on a large scale

is impracticable. The French have developed a chemical process which is highly satisfactory in making real rubies, large numbers being produced each year in Paris.

Cheaper stones that look like precious gems are also used in making imitations. So closely do they resemble the real thing that people who are not experts in testing gems are often deceived. Cheap stones are colored to resemble carnelians and agates; and clear quartz, Brazilian topaz, and colorless sapphires and emeralds are often sold as diamonds.

As decorations, the well-made imitations serve as well as genuine gems; and owing to their low cost, the average person may be able to afford quite a variety of attractive pieces.

GENERAL. See **RANK**.

GENERAL STAFF. That part of the army which works out the important plans is commonly referred to as the General Staff. First used in Germany, where it is known as the Great General Staff, the organization has since been adopted by most other countries.

The Chief of Staff of the United States army holds the temporary rank of general during his time in office. Under his direction, the General Staff plans and co-ordinates the development of the army and assists in directing its field operations. The Army Chief of Staff is a member of the Joint Staff in the Department of Defense.

GENESIS, jen' e sis. "In the beginning God created the heaven and the earth."

These are the first words in the first book of the Old Testament of the Bible. When the Greeks translated the Bible, they used the name *Genesis*, which means *birth* or *creation*, for the first book. *Genesis* deals with the creation of the earth and of man, the fall of man, the great flood, and the spreading of the human race throughout the world. In a second division it tells of the beginning of the Jewish race. See **BIBLE**.

GENET, zha na', EDMOND CHARLES EDOUARD (1765-1834). The struggling, war-

weary United States, trying to stay at peace with the world and organize her internal affairs, was plunged into its first international crisis in 1793 by Edmond Genêt, a Frenchman. Appointed minister to the United States during the French Revolution, Genêt toured the country, signing up recruits for the French army engaged in war with England.

Great Britain protested, and President Washington, wanting to keep out of war, ordered Genêt to desist. But Genêt did not heed the order, and Washington was forced to demand his recall. Before Genêt could be sent home, however, the Girondist party in France, to which he belonged, was overthrown by the Jacobins; so he decided to stay in America. He became an American citizen, married a daughter of New York's governor, George Clinton, and settled in New York.

One of the oldest European cities, Geneva now has fine hotels and residences in the upper part of the city; the business district and poorer sections are found in the lower town. Important among the buildings of the city are the palatial League of Nations building; the Cathedral of Saint Peter, built in the eleventh century; the university; the Musée Fal; the Musée Rath, and the Town House.

Chief among the industrial plants of this busy little city are the factories producing watches, jewelry, and music boxes. Air lines and railways connect Geneva with leading European cities. Among the world-famous men who have lived in Geneva or who were born there are Calvin, Le Sage, Knox, Rousseau, and Necker. Geneva has long been distinguished in science and literature; and it has been the scene of many international meetings. Because it



GENEVA, *je ne'vah*, SWITZERLAND. Lying at the extreme southwestern end of the Lake of Geneva in Switzerland is the city of Geneva, home of international agencies. It is split into two parts by the Rhone River, which flows from the lake southward through France, and the most important section of the city is on the south bank of the river.

has an excellent location, Geneva was the home of the League of Nations and is the headquarters of the International Red Cross. Its population is about 167,000.

GENGHIS KHAN, or JENGHIS KHAN, *jen' giz kahn* (1162-1227). An empire more vast than that of Alexander the Great or Rome was created by Genghis Khan, greatest of all the Mongol con-

querors and rulers. With one of the most powerful military machines in history, he extended his domain from the Black Sea and the Tigris River east to the Pacific, and from the middle of Siberia south to the Himalayas.

His real name was Temujin, but he received the title Genghis Khan, *great ruler*, in 1206, when he had succeeded in bringing all the Mongolian tribes under his control. His father, who was chief of the Mongols, died when Temujin was only thirteen years old, and many of the tribes refused to recognize him as their head; but after years of fighting, he was able to command their allegiance.

Following the establishment of the Mongol empire, in a series of terrible wars with the Tartars in Northern China, he brought them under his rule; then he and his three sons continued their conquest to the south and east, until their empire included all of China above the Yellow River. Next this mighty army swept over Western Asia and into Europe as far as the banks of the Don and the Dneiper.

In 1227, while returning to Karakorum, his capital, after renewed warfare in China, Genghis Khan became ill and died. His great domain was divided among his four sons.

During the reign of Genghis Khan, education and arts were encouraged and efforts were made to bring about an understanding with Europe. His intentions were not understood, however, and after his death the opportunity for unity and common enterprise disappeared.

GENII, *je'ni i*. What a marvelous world this would be if genii really lived! We could all be Aladdins, rubbing our magic lamps, and reclining at our leisure while these trusty spirit servants performed the tasks of the world. During the time of the Romans, the people really believed that such spirits existed. They thought that a genius, who, of course, could not be seen, brought each person into life, guided him from youth to old age, and accompanied him when he died. We make their ac-

quaintance in the stories of the *Arabian Nights*, in which they are perfect servants.

GENTIAN, *jen'shun*, FRINGED. Famous alike for the remarkable grace of its flower form and its exquisite shade of pure azure, the fringed gentian was described by William Cullen Bryant in the lines—

Blue—blue—as if that sky let fall
A flower from its cerulean wall.

The poet little realized, however, that the fame of his poem would cause so great a demand for the graceful flowers that the very existence of the fringed gentian would be threatened as a result. At present it has become extinct over wide areas, and is now among the rarest of our wild flowers.

The fringed gentian opens its flowers during sunny fall days and closes them tight when the sun fails to shine. The fringe is thought to be a device to protect the flowers against robber insects, but ants, the principal offenders in this respect, seem to have little difficulty in crawling between the fringes. The fringed gentian thrives best in open woods and moist meadows.

GENTILES, *jen'tilez*. When the Christian religion was first founded it was taught only to the Jews. Then Christ said that it must also be taught to the Gentiles, by whom He meant all those people in the world who were not Jews. One of the first men to teach Christianity to other races was Paul, known as the "Apostle to the Gentiles," and in the early history of the Christian Church there were more Gentiles than Jewish members. Today the Mormons consider all those who are not of the Mormon faith, Gentiles.

GENUS, *je'nus*. In classifying plants and animals, scientists group together species having certain characteristics in common. A group of such species is a genus (plural, *genera*). The scientific name of a plant or animal consists of two words—the genus name and the species name. When they are combined, the genus name is abbreviated. For example, the red fox belongs to the genus *Vulpes* and to the species *fulvus*. It is known as *V. fulvus*. See CLASSIFICATION.



GEOGRAPHY. Modern geography may be described as the science of *relationships*. It seeks particularly to point out the relationships between the physical features of the earth, and the nature, location, and activities of the living things on the earth. This type of geography not only tells us, for example, where the big centers of wheat production are, but also tells us why. It bids us remember not only that Chicago is a big meat-packing center, but it explains why the industry has centered there. In this respect it differs from the older form of geography which insisted upon the memorizing of facts, but was very deficient in explanation of causes and relationships.

Field of Geography. The whole field of geography is a broad one. It may, however, be so divided that it can be clearly seen. The principal subdivisions are two.

The first subdivision deals with the physical features of the earth as the causes or influences which affect the behavior of living things. This aspect of geography is called *physical geography*. The earth factors which have an important influence over the behavior of living things are (1) climate; (2) the oceans; (3) the distribu-

tion of the land masses of the world; (4) the shapes of the land surface; (5) the soil; (6) the nature and abundance of mineral resources.

The combination of these influences makes up what we may call our geographic surroundings, or *environment*. In this environment plants, animals and men live. The particular combination of these influences in any part of the world has much to do with determining what kind of plants, animals, and men shall live there, and how they shall live. In other words, plants, animals, and men respond to their geographic environment. The study of these responses constitutes the second of the principal subdivisions of geography. This aspect of geography may be subdivided into (1) *plant geography*; (2) *animal geography*; and (3) *human geography*.

Plant geography and animal geography describe the influence of physiographic factors upon the nature, distribution, and activities of plants and animals. These studies are closely related to the fields of botany and zoology and usually constitute parts of them. Because of their close connection with agriculture, however, they are



Above, courtesy American Museum of Natural History

THE WORLD OF ANCIENT MAN

The Hindu conception of the earth (above). Magellan (right) climaxed a great period of discovery with his voyage around the world.



of very great importance in the study of human geography.

We feel a keen interest in any phase of learning that touches closely upon our own lives. For this reason, no doubt, the human aspect of geography is receiving more attention than the others.

Human geography concerns itself with the influence of nature on man and his activities. This phase of geography, as a result of its great interest, has been subdivided into a number of fields, each of which deals with some aspect of human life. Following is a brief description of each of the subdivisions of human geography:

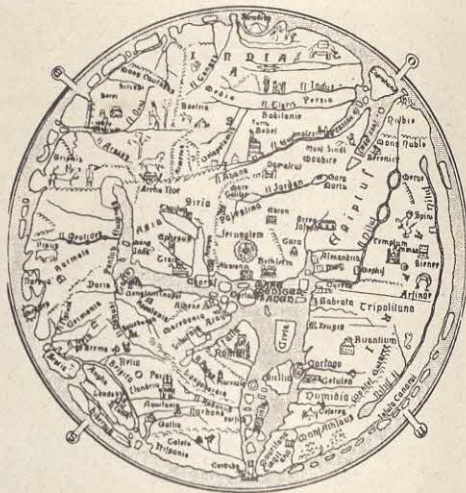
Historical Geography. From his earliest days on earth, man has been curious about the lands that lay beyond the horizon. He has yearned to cross the ocean, to climb the highest mountain, to go down into the deepest caves—to see what his world was like, with his own eyes. It is significant that the ancient Phoenicians, great sailors and merchants, should be among the first to master a practical written alphabet; they were able to set down their observations of the world over which they roamed and so pass on geographical knowledge to succeeding generations.

The Greeks, Romans, Egyptians, and other peoples of the Mediterranean learned

more about far countries in their numerous campaigns of conquest. Their storehouse of knowledge laid the foundations of such sciences as astronomy, geology, physics, and mathematics; the sciences enabled the explorers of the Middle Ages to extend their range of travel. Marco Polo by land, the vikings and Columbus by sea, pushed out great projections in the known world's boundaries, both east and west.

Philosophers found that the influences of climate, topography, and other geographic features on the history of peoples have been continuous and by no means least important in shaping the development of nations. The early explorers of North America found their lines of commercial penetration and settlement directed by such physical features as the Saint Lawrence River and the Great Lakes and by the Mississippi Valley. As a later date, when colonists of the Middle Atlantic states desired to emigrate westward, they found the great wall of the Appalachian Mountains in their way.

Hardy frontiersmen, among them Daniel Boone, pushed ahead through the mountain valleys and passes and discovered river-made gaps which led through the mountain ranges into Kentucky and the Ohio



"WRITING DOWN" THE WORLD

The stone Babylonian map (left) shows the ocean marked by a circle in which is enclosed the world. Above is the Hereford map of 1307.

River country. In the history of nations, ancient or modern, we find that the geography has influenced the distribution of population, the location of cities, and the character of products and industries.

Political Geography. It is equally true that the size and shape of countries is often influenced, at least in part, by geographic features. This is, perhaps, most true of Europe, where some political boundaries have remained for centuries fixed by a mountain chain or a body of water. Modern transportation enables such features to be more easily crossed than formerly and tends to decrease their importance as political boundaries.

Military Geography. The influences exerted by mountains, valleys, streams, and conditions of weather and climate upon the conduct of military campaigns was so much appreciated during World War I that persons specially trained in geography and geology were attached to the armies in France to give advice on these matters. In World War II, officers were trained in map reading and landscape characteristics.

Economic Geography. Perhaps the most generally interesting of all the aspects of human geography are those which discuss the influences exerted by earth conditions on the various ways by which man makes his living. This field, which we may call *economic geography*, is further subdivided into *commercial geography*, *industrial geography* and *agricultural geography*. Each of these points out how geographic conditions influence the conduct of a particular kind of human endeavor.

Commercial geography describes the influence of geographic conditions upon the exchange of commodities, or trade.

Industrial geography shows how the influence of geographic conditions affects manufacturing. For instance, it explains that great steel plants in the United States are located either at Pittsburgh or at Gary because it is more economical to transport iron ore from the Mesabi Range of Northern Minnesota toward coal deposits and the steel market, by way of the Great Lakes, than it would be to take the coal to the ore deposits.

Agricultural geography outlines the influence of climate, topography, and soil on



THE WORLD OF THE SIXTEENTH-CENTURY MAP MAKERS

This map, made for Henry II of France in 1546, shows how much was known of the world at that time. Above the equator the map is reversed.

crops and cattle. As an example, it explains the location of American wheat, corn, and cotton regions. Heat and humidity favor cotton but encourage fungus pests and help prevent wheat growing in the South. Low summer rainfall and dry winds keep corn out of the Pacific coast states. Severe winters and light snowfall in North Dakota damage winter wheat and make spring wheat the main crop. Differences in rainfall and soil composition make the wheat of Maryland soft and that of Kansas hard and determine the character of the flours that may be made from them.

Geography as taught and studied today is not merely a mass of facts and figures about the size, shape, and population of the earth; it is a vital and interesting element of the social studies, allied to the sciences and important to the social adjustment of the educated man or woman.

A large proportion of the material in these volumes is devoted to the geography of the continents, countries, and economic regions of the world. Articles, too numerous to list here, will be found under appropriate place names and under such titles as AGRICULTURE, CLIMATE, FOOD, CORN, COTTON, PHYSICAL GEOGRAPHY.

GEOLOGICAL SURVEY OF THE UNITED STATES. Valuable work is carried on by this scientific organization, established in 1879 by the United States government for the study of geology and the related natural sciences bearing on the welfare of citizens. Most of the states have similar surveys.

Mineral Resources. The chief activities of these geological surveys are directed toward finding out what the mineral resources of their states are, where they are, and their quality. Reports are published to inform people on these subjects, so that industries may be built up to supply the various needs of the public and thus add to their wealth. The United States Geological Survey co-operates with the state surveys in collecting yearly statistics of the many mineral products, and publishes reports each year covering the more valuable minerals.

Scientists study and map the rocks and all indications of valuable ores, coal, oil, building stone, clays, road materials, and other natural resources that may be of value.

All these surveys examine free of charge minerals that are sent in, and report to the senders what the minerals are and their probable value, if any.

Soil Surveys. The most valuable natural resource is the soil. Many state geological surveys co-operate with the United States Department of Agriculture in making surveys of the soils in their states, and publish valuable reports and maps showing for what crops they are suited. These maps are of much value to farmers.

Water Resources. The second most valuable natural resource is water. The Geological Survey determines where artesian wells may be drilled, where water

power is available, and where public drinking-water supplies may be secured. It also locates water for irrigation purposes.

Topographic Maps. The surveys of the states and the United States co-operate in making topographic maps which show in great detail the hills and valleys, the streams and springs, the roads, houses, railroads, cities, and villages, the quarries and mines, and all features that make a complete map. These maps are sold at nominal prices to any one who wants them.

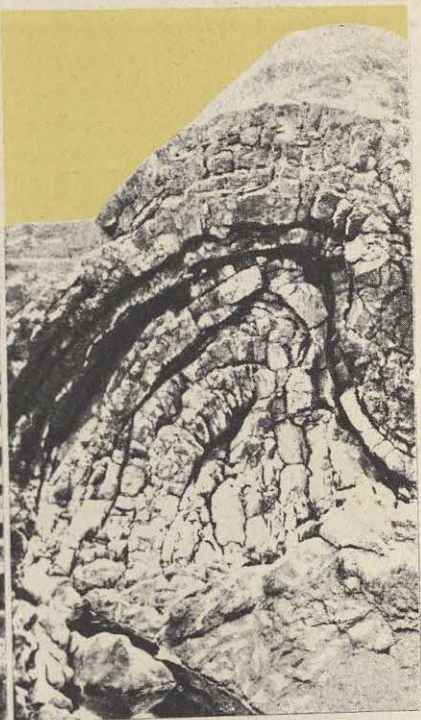


The History of Our EARTH

GEOLOGY, *je ol'o je*. Night and day, year in, year out, century after century, Mother Nature is continuously at work reshaping and reworking the materials of which the earth is made. Man, because his life is short, is apt to think of the earth as being permanent and fixed; actually, it is changing in structure, composition, even appearance, every hour of the day.

The study of this endless change is the

science of geology. Geology examines the earth's substance, its minerals and rocks, water, and atmosphere, its inhabitants, and its relation to the universe. It seeks all the truth about the origin of the earth, its long and often violent history, its present rate of change, and its influence upon the ever-growing plant and animal life that dwells upon it. And geology reads that truth in the earth itself.



THE MAKING OF THE MOUNTAINS AND THE HILLS

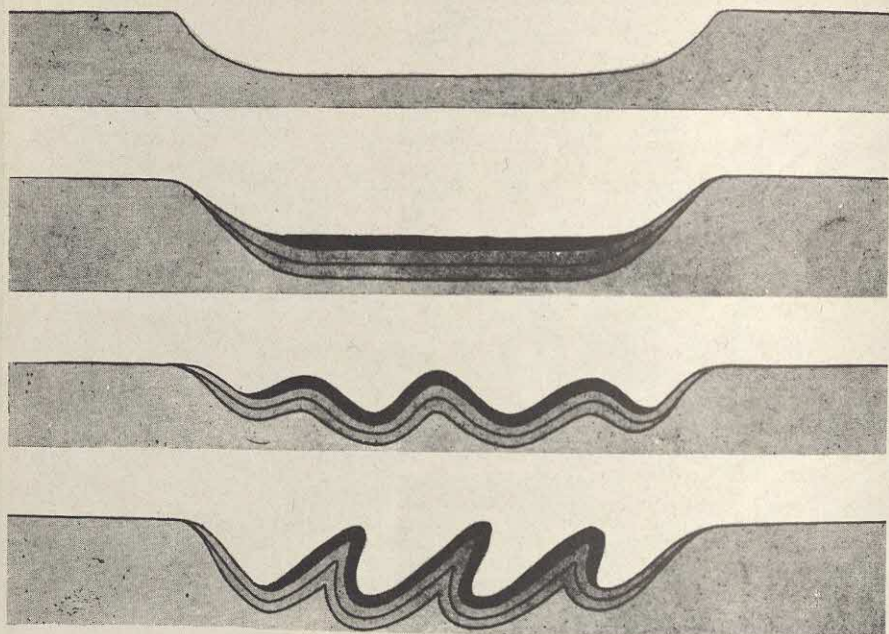
Adjustment of the rock skin of the earth has caused great wrinkles in it and folded the rocks to form our hills and valleys. Here are examples of two of these "pleats" in the crust.

Nothing is changeless about the earth except change. Swollen rivers surge toward the sea, bearing millions of tons of silt—old land which will make new land in a different location. Grim volcanoes gush forth floods of white-hot lava, to spread, congeal, and make new rock. Steely glaciers grind their way through deepening valleys, etching a record of Nature's untiring energy. The surf pounds on a receding coast; winds blow, rain falls, the sun beats down, earthquakes shake the ground—these are the natural agencies which continue to alter the earth's crust and furnish geologists the evidence upon which to reconstruct the life story of the earth.

The Obscure Beginnings of Earth's History. Men knew a great deal more about the stars than they did about the ground they walked on until the modern science of geology evolved during the eighteenth and nineteenth centuries. Astronomy,

physics, and chemistry were called upon for a logical answer to the question of how the earth originated. Scientists are now practically agreed that the solar system developed from a nebula, or mass of gaseous matter, and that the earth is one of the planets formed by the concentration of the particles (*planetesimals*) in that mass. The planetesimals were the result of the cooling of gaseous particles. It is believed that the parent nebula was subject to the attraction of a large star which once passed close enough to it to produce huge bulges or arms in its surface. Some of these arms broke away and began revolving in orbits about a common center. The smaller planetesimals fell into larger ones, as their orbits crossed, and thus were formed the planets and their satellites, and the planetoids. The nucleus of the parent nebula became our sun.

Gradual cooling and solidification, in the case of the earth, produced the first rock.



GIGANTIC PRESSURE TURNS SEDIMENT INTO ROCKS

Cliffs along the seashore often show the layers of rock which form the earth's surface. These were formed from sediment which, after settling in the sea, was cemented and pushed to the surface.

The chemical and physical changes taking place in this rearrangement of matter produced the atmosphere and the water vapor in it. Thus the three great divisions of the earth's material—the lithosphere (rock), hydrosphere (water), which covers about three fourths of the earth's surface, and atmosphere (air)—are accounted for by the quite generally accepted *planetesimal hypothesis* of the origin of the earth.

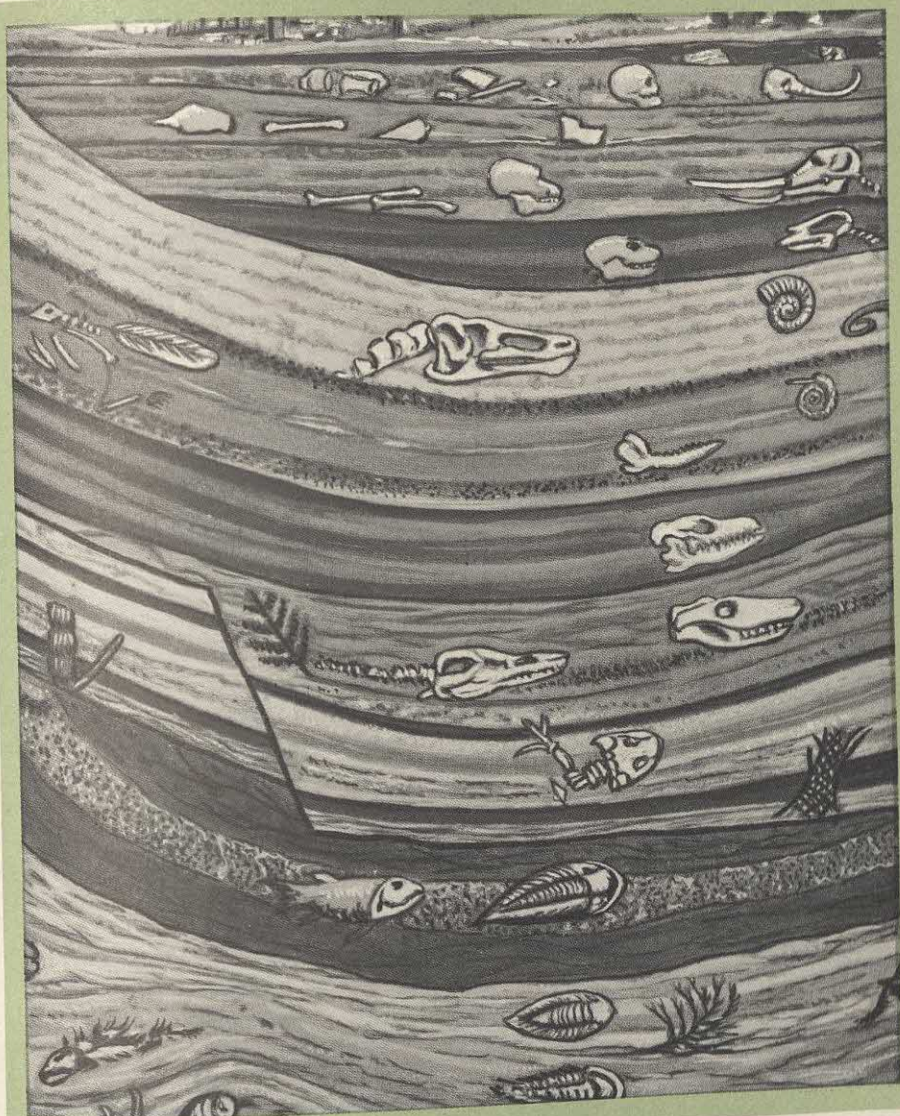
Other hypotheses, notably those of Laplace, Lockyer, Darwin, and, more recently, Jeans and Jeffreys have been given prominence. They, too, are based on the belief that the earth originated in a nebula, but differ from the planetesimal hypothesis in their theories of its evolution.

How Rocks Write Their Own History.

Although the exact manner in which the earth was formed may forever remain ob-

scure, it seems reasonably sure that it progressed through successive stages as nucleus, small volcanic planet, growing planet with atmosphere and water retained, larger volcanic planet supporting life, and the mature weathering planet we know today.

Only the surface of the earth is accessible for geologic study, but this is sufficient to show that three agencies have produced its surface features. These three agencies are (1) *diastrophism*, the technical term for all movements of the earth's rock crust in adjusting itself to the compacted core; (2) *volcanism*, which includes all changes effected by molten rock (lava) either at the surface or underground; and (3) *gradation*, the processes by which wind, rain, running water above or below ground, ice, waves, etc., either wear down the land or build it up. To a certain extent, living or-



PAGES IN THE EARTH'S HISTORY BOOK—FOSSIL DEPOSITS

In the layers of the crust of the earth are countless clues to the beginning and growth of life. Each rock system represents a great period of the past, and each contains evidence of the life of the time, from primitive protozoans to the primates whose remains are found in the younger strata.

ganisms assist in the process of gradation.

These processes have operated continuously since the formation of the earth's three great divisions, with volcanism most important in the earlier stages and crustal movements and gradation in recurrent

cycles most important in the era of recent life. The oldest-known rocks, the lowest layer which can be inspected, are *igneous* rocks. Igneous rocks are formed by the cooling and solidifying of melted rock; granite, dunite, and basalt are typical of this



WRINKLES IN THE SKIN OF THE GLOBE

As the earth's core contracts, the crust folds upward and forms great mountain ranges.

class. Hence it is believed that the original material of the earth was igneous rock.

By far the greatest part of younger rock is *sedimentary* rock, composed of the cemented and hardened sediments which settle in lakes, oceans, and slow-moving streams. This class of rock may be composed of bits of older rock which have been weathered by heat, cold air, moisture, or the growth of organic matter, and carried to settling basins by rivers, glaciers, wind, etc. Sedimentary rocks, like sandstone, shale, and limestone, are naturally deposited layer upon layer. These layers, or *strata*, are sometimes folded or broken by earth movements or altered by the intrusion of lava.

The heat and pressure caused by these two geologic processes, diastrophism and volcanism, often completely change the character of the sedimentary rock. Such changed rock is called *metamorphic*. An example is marble, which was deposited as limestone, or slate that was originally mud, then shale. The pressure of metamorphism generates heat, and heat in the presence of water causes chemical changes in the rock, producing new compounds and different crystallizations. Some of the most useful minerals, such as graphite, talc, and garnet, are products of metamorphism.

Earth and Life in Rhythmic Changes.

The successive order of beds of stratified rocks shows the relative age of the strata and also reveals, in the remains and traces of plant and animal life in the strata themselves, the nature and development of the

earth's fauna and flora from the very beginning. These records of the organisms of past ages are *fossils*, the specialized study of which is the branch of geology termed *paleontology*. Rock layers large enough to be mapped are *formations*, and the intervals of time required for their individual deposition are called *stages*. Formations are grouped in larger units called *rock systems*, which identify geologic *periods*, and these are grouped in the five *geologic eras*.

The strata of periods are similar in formation and fossils, while eras are set apart by profound unconformities. The recognized eras are the *Archeozoic*, dimly reconstructed era of primitive earth history; *Proterozoic*, or era of first known life; the *Paleozoic*, era of ancient life; *Mesozoic*, era of middle life; and *Cenozoic*, era of recent life. The older eras, the Archean and Proterozoic, are believed to have occupied about two thirds of the earth's life, the Paleozoic about one fifth, the Mesozoic about one fifteenth, and the Cenozoic about one twenty-fifth. By timing current geologic processes and the rate of disintegration of existing rocks, it has been shown that the oldest rocks, the Archeozoic, are about 1,800,000,000 years old. No fossils appear in them; the first indication of life is inferred from deposits probably formed by bacteria in the hydrosphere during the next to the oldest era, the Proterozoic. Following are the geologic periods, the oldest at the bottom. The lowest estimate of the age of the earth is two billion years. Many authorities place the figure much higher.

CHART

5. Cenozoic (recent life)	Present Pleistocene, or Glacial	Late stages of the Ice Age. Changes in climate, due to geologic activity, produced vast glaciers which made four advances and retreats in America and Europe. They made huge deposits of <i>glacial till</i> . Great Lakes were formed. A period of great terrestrial deposits, closing with a time of great crustal deformation. The age of the mastodons and the Java man. Pacific Coast and Cascade ranges formed. Geography of this period is much like that of the Eocene. Southern California a sea. Ruminants from Asia invade America. True apes appear.	Quaternary	The "Age of Man." The present is a quiet period of gradation, with the land being worn down.
	Pliocene	Many strata of Europe and North America were formed in this period, notably around Scotland, Ireland, Italy, and the Caribbean region and the Gulf states. Modern animals continue to develop.	Tertiary	The "Age of Mammals" saw the rise of the Cordilleran and Rocky Mountain ranges, the Alps and Himalayas. It was marked by the development of present plant and invertebrate animal life, and the growth of the chief modern mammalian strains, as the horse, the elephant, and the <i>primates</i> , including man. Many gems and valuable minerals formed by igneous activity.
	Miocene	Limestone beds of this period are found at an altitude of 10,000 feet in the Alps and at 20,000 feet in Tibet. Modernization of plants and animals takes place rapidly.		
	Oligocene	Thousand-mile-wide sea from Gulf of Mexico to Arctic Ocean. Great chalk deposits laid down by shells of Foraminifera. Palms grow in Greenland. Rocky Mountains formed. Period of the dinosaurs in Western United States. First bird fossil. Cycads, conifers, and ginkgo trees grow. Sierra Nevada range was formed.		
	Eocene	The age of flying reptiles, sea serpents, and land monsters. Conifers appear and the trees of the Petrified Forest of Arizona grow. Palisades of the Hudson formed by volcanism.		The "Age of Reptiles." Mammals insignificant but developing. General emergence of continents marked this medieval era, but the Cretaceous seas were the greatest in geologic history. The Mesozoic saw the dinosaurs and flying and swimming reptiles, the rise and fall of the cephalopods, the first birds and the first flowering plants, the small beginnings of the mammals.
4. Mesozoic (middle life)	Cretaceous	Extensive glaciation. Appalachian and Andes mountains formed. Limestone deposits. Age of brachiopods, and first true insects. Coal beds forming.		An era of successive submergences of the land, separated by periods of mountain-forming upheavals. It was closed by the Appalachian revolution. Called "the Era of Marine Invertebrates."
	Jurassic	Extensive coal swamps. First record of land animal. First trees. White Mountains, of granite, formed in what is now New Hampshire. Continents again flooded by shallow seas. Coral islands in Middle West. First air-breathing animal appears. Warm climate. Fifty per cent of North America under water. Limestone deposits in Middle West.		
3. Paleozoic (old life)	Triassic	Beings with abundant fossil record. Trilobites and other marine invertebrates.		
	Permian Carboniferous (Pennsylvanian and Mississippian)	Extensive deposition of sedimentary rocks, especially at Ontarian, Appalachian, and Cordilleran <i>geosynclines</i> . Extensive deposits of native copper in Keweenaw system in Michigan. Lake Superior iron-ore deposits in Huronian system. Era included earliest Ice Age in Huronian and closed with the folding of the Killarney Mountain Range, composed of rock eroded from the Laurentians to the north. Occasional fossils, carboniferous shales, and iron deposits indicate existence of life. Glacial deposits indicate era of cold climate.		
2. Proterozoic (earlier life)	Devonian			
	Silurian			
1. Archeozoic (ancient geology)	Ordovician			
	Cambrian			
	Keweenaw			
	Huronian			
	No fossil record.	Granite and other igneous rocks. An era of crust faulting and folding, closed by the Laurentian revolution, forming mountains in Canada, from Labrador to north of Minnesota.		

It is easy to see that earth history has run in recurrent cycles, each era closing with upheaval, revolution, or "rejuvenation" of the land. The order of events is: (1) *sedimentation*, a period in which new rocks are bedded, the continents gradually subside to be covered by the sea, and the climate is mild because of the wide circulation of ocean currents; (2) *revolution*, when the earth's crust is folded by adjustment to unequal pressures, the seas withdraw, erosion is more rapid, and climatic extremes are set up by elevation of the land and restriction of tempering ocean currents. It is believed that stresses accumulate in the shrinking earth until they outbalance the resistance of the earth, and deformation follows.

Monsters of the Mesozoic. Man must think in millions of years to appreciate the profound changes which the cycle of earth history works upon life, although no single generation seems to be affected. The marvel of the appearance of life in the successive geologic periods does not seem such a sudden event, when viewed in the perspective of the eras, and the hypothesis of its divine creation is easily reconciled with the theory of life's natural synthesis from elements on the earth's surface.

Reconstruction of prehistoric animal forms, made possible by study of fossils, presents some interesting and terrifying pictures. Men might well have enjoyed the world when tropical climates prevailed in the far north, or been at great disadvantage when the great coal swamps and shallow seas covered much of the land. The age of reptiles, too, would have been a long nightmare for human beings.

In this age, they would have been at the mercy of lizards thirty feet long, the *megalosaurus*, of giant bats with wings twenty-five feet across, of frightful land animals like the carnivorous *tyrannosaurus*, a biped forty-seven feet long. Monster dinosaurs roamed every continent—the herbivorous *brontosaurus* and the eighty-seven foot *diplodocus*; the armored *stegosaurus* and the horned *triceratops*. In the age of mammals, also, there were terrors

upon earth: the *clothere*, a savage giant pig; the horned *titanother*, something between a rhinoceros and an elephant; the saber-toothed tiger, mammoth, and giant sloth.

The Nature of Earth's Cycles. The known lithosphere is limited to the outer shell, which is related to the whole somewhat as the skin of an orange is to the fruit. In this crust, the average occurrence of chemical elements, found combined as minerals, has been determined: oxygen, silicon, aluminum, iron, calcium, sodium, magnesium, and potassium make up about ninety-eight per cent of the earth's surface. The deeper rocks are believed to be composed chiefly of the minerals quartz, feldspar, ferromagnesian, and micas, as revealed by formations brought to the surface in deep-seated earth movements. Minerals are of great economic importance; their study forms the branch of geology known as *mineralogy*.

Dynamic geology treats of the work of geologic agencies in producing the surface features of the earth. With constant erosion, all the land surface would eventually be reduced to a common level, with the result that the sea would cover the whole world, bringing land life to an end. Offsetting erosion are those movements of the earth's crust that periodically raise the continents before they sink beneath the waves. Evidences of this restoring action are seen in high land and mountains formed as wrinkles in the skin of the planet.

Ocean beds are made of heavier rock than that which forms the land and consequently sink lower, creating enormous horizontal pressures which gradually fold rock strata into alternate upfolds—*anticlines*—and downfolds—*synclines*. Tension and compression in earth movements produce *normal* and *thrust faults* which fracture and displace strata. Faults which occur suddenly cause earthquakes. These faults may result from landslides, the falling-in of caves, volcanic disturbances, etc.

The world's main earthquake belt runs through the northern basin of the Pacific Ocean and south along the western coasts

of North and South America. A less active belt extends from Portugal, through the Mediterranean, the Caucasus and Himalaya mountains of Asia, into the East Indies. *Seismographs* record vibration waves set up by earthquakes. Scientists use the recordings to study the kinds of material that can be found in the earth, and the stresses that are produced underground.

The earth is heated externally by the sun. Owing to the rotation of the planet and the inclination of its axis, the sun's heat is distributed unevenly, the temperature being greatest in those sections which receive the rays directly. Inequalities of heating cause alternate evaporation of water from the seas and precipitation of rain.

The earth is heated internally by the compression of its materials and by radioactive changes in their elements. This interior heat gives rise to volcanism. Lava wells out through or between layers of near-surface rock and out of volcanoes. It frequently deposits great sheets of igneous rock. Or the lava may break through strata and solidify below the surface. On the surface it is an *extrusion*; below, an *intrusion*. Sometimes, intrusions will raise surface strata, as in the case of Utah's Henry Mountains. Lava which cools rapidly produces fine-grained rock, like basalt, while that which solidifies slowly, underground, results in coarse, crystalline rock such as granite. The chemical and physical changes brought about in rocks by volcanism create the metamorphic rocks and sometimes cause the formation of valuable ores and minerals.

Surface land is constantly worn away in the process of gradation, and the material is redeposited, usually at a lower level. Thus gradation is a leveling or aging process.

Wherever the fluid components of the earth—air and water—come in contact with the land, they have a leveling effect. Rock weathering, the physical disintegration and chemical decomposition caused by heating and freezing, the wedging action of plant roots, the action of water, etc., break down rock until it can be carried



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A MOUNTAIN BLOWS ITS TOP

This cross section shows how underground pressures blast outlets in the earth's crust.

away in fragments by wind, ice, water, and gravity.

Wind carries sand and dust particles and deposits them when it meets obstacles or when it subsides. Streams down-cut and side-cut the land, carrying much debris away and depositing it on flood plains or in the sea. The age of a stream is shown by the cross section of its valley; V-shaped valleys are young, U-shaped valleys are mature; wide flat valleys are of old age. The regions surrounding valleys usually reflect the age of the streams; uplands with few streams are young; areas creased by many streams and their narrow divides are mature; wide bottom lands are old; the absolutely flat *peneplain* has reached the ultimate in erosion.

Streams drop their loads when they slow up or the volume of water is decreased, making deposits such as deltas and alluvial plains. Underground streams seep through porous strata, excavating caves by dissolving out minerals. Frozen streams, or glaciers, progress by reason of their weight, scouring out great quantities of debris from their valleys. This debris they transport unsorted, depositing it as *glacial till* when they

melt, as in *terminal moraines* (at the terminus), *lateral moraines* (along the sides of the valley), and *ground moraines* (under the glacier).

Streams flowing beneath or out of melting ice also make *fluvio-glacial* deposits; those laid down in tunnels under the ice are held to distinctive shapes, such as ridge-like *eskers*. Glaciers sometimes erode their main valleys deeply, while tributaries are not eroded to the same level; when the ice is gone, the tributary valley may be left at a level higher than the main valley, producing that geologic oddity the *hanging valley*. Glaciers also produce fjords by deepening the mouths of valleys.

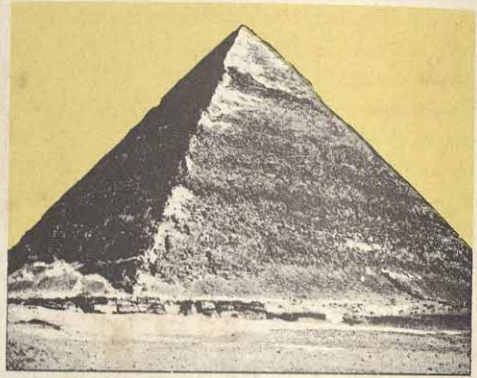
Waves, undertow, and shore currents of lakes and oceans are other agents continually eroding the edges of the land and depositing the material in deeper water. Submerged shores characteristically have *drowned valleys*, headlands, cliffs, and islands, and reach maturity when simplified in outline.

Thus it is possible to see all the geologic agents at work and all stages of their effects wherever there is land.

For further information, see the numerous articles throughout these volumes under the names of the earth's materials. See, also, EARTH; PHYSICAL GEOGRAPHY.

GEOMETRY, *je om'e trih*. There is no greater satisfaction than that of solving a perplexing problem by clear, logical thinking. Geometry is a subject which furnishes this mental enjoyment; if it is pursued understandingly, it is certain to develop one's pleasure in reasoning. The Greeks, who were the first to study geometry as a science, believed in its power to train the mind.

The value of geometry is not wholly cultural, however, since the subject has a practical worth, also. Indeed, geometry arose because of a practical need for it. Its Greek meaning, *measurement of the earth*, is evidence of its original use; and the thorough investigation of geometry by the Greeks was carried on so that the measurement of the earth and its spaces might be simplified.



GEOMETRY'S OFFSPRING

The pyramids of Egypt are striking examples of geometry applied to building construction.

Long before the Greeks began their study of the measurements and properties of spaces and objects, the Egyptians had worked out simple rules to guide themselves in their surveying and construction work. Because the great Nile River overflowed its banks annually and farming areas in the Nile basin consequently varied in size from year to year, the land was being surveyed continually. The Egyptians, therefore, discovered many properties of rectangles and triangles which were later gathered into the subject of geometry. They discovered even more truths about the measurement of space when they built the great pyramids.

It remained for the Greeks, however, to organize all these truths and classify them under the name *geometry*. The Greek mathematicians, Thales, Pythagoras, Euclid, Plato, and Archimedes, pursued the study of geometry so thoroughly that comparatively little has since been added to the truths which they recorded. Euclid in particular is to be remembered, for it was he who collected all the geometrical facts discovered up to his time (300 B. C.), made additions to them, and set them down in logical order in a work called the *Elements of Geometry*. The parts of this work which deal with elementary geometry are still the basis of textbooks in many schools. In fact, it is not unusual for students to speak of studying their "Euclid" instead of studying

their "geometry," the school term employed.

Today, geometry serves as the basis of all measurement. Any conception of a distance, either along a straight line or along a curved line, involves thinking in terms of geometry. The area of a flat surface, or the volume of a solid object, would mean absolutely nothing to us if we had not learned in geometry that areas are bounded by lines and volumes are bounded by areas.

How Geometry Was Built. Euclid's development of geometry in the *Elements* is amazingly simple. First he set down certain *axioms* and *postulates* which had to be accepted as true. He assumed the truth of these axioms and postulates to be self-evident, although he confined the postulates to ideas purely geometric, whereas the axioms were general, not limited to geometry. These axioms and postulates can be stated simply, as follows:

Axioms:

If equals are added to equals, the sums will be equal.

If equals are subtracted from equals, the remainders will be equal.

The doubles of equals are equal. (And so for all multiplication and division.)

The whole is greater than any of its parts.

The whole is equal to the sum of all its parts.

Postulates:

Any magnitude (length, area, volume) can be bisected (divided into two equal parts).

A straight line can be extended indefinitely in either direction.

A circle can be drawn with any radius and from any point as center.

Only one straight line can be drawn between two points.

Through a given point, one and only one straight line can be drawn parallel to a given line.

With these truths as his only known facts, Euclid established hundreds of geometric truths, called *theorems*. After proving any one of these theorems, he was able to use it as a factor in the proof of something new. In this way, the entire structure of geometry was built up, fact upon fact.

Every theorem consists of a *hypothesis* (known or previously proved condition) and a *conclusion*, that which is to be proved. Take the theorem:

If in two triangles the sides of one are

equal, respectively, to the corresponding sides of the other, the triangles are congruent (they will coincide exactly if placed one upon the other).

In this theorem, the phrase *the triangles are congruent* is the conclusion. Everything else makes up the hypothesis. By drawing the proper implications from every fact in the hypothesis, it is possible to prove the truth of the theorem.

There are two principal methods for proving geometric theorems, direct and indirect. The direct method consists of proceeding by a series of direct, logical steps from the hypothesis to the finally obvious conclusion. There is a reason for each step, and no fact can be stated which has not previously been proved. In the indirect method, a start is made with a supposition which is assumed to be true but which may or may not be true. Then, by using only known truths, a conclusion is worked out. If the conclusion is in harmony with a known truth, the original supposition is conceded to be true; if it obviously violates a known truth, the supposition is shown to be false.

Types of Geometry. Modern geometry has several branches which fall under two main headings—elementary and advanced. Elementary geometry consists of *plane* geometry, which deals with figures in the same plane (lines, angles, polygons, and circles); and *solid* geometry, which deals with solid figures—that is, those which have three dimensions (cones, cubes, prisms, cylinders, and spheres).

Elementary geometry was the only geometry studied in ancient times. Now, however, advanced geometry includes spherical, analytic, descriptive, projective, and non-Euclidean. *Spherical* geometry deals with figures described on the surface of a sphere; *analytic* geometry involves the application of algebra to geometry and to problems arising out of them; *descriptive* geometry deals with the reproduction of solid figures on a plane; *projective* geometry treats of plane figures produced so as to correspond point by point with other figures on differ-



GERMAN KINGS OF ENGLAND

The Georgian period in English history was one of foreign rule.
 (1) George I, elector of Hanover, king from 1714 to 1727.
 (2) George III, king from 1760 to 1820. (3) George IV,
 who reigned but ten years; 1820 to 1830.

ent planes, relative position instead of size being the most important consideration; *non-Euclidean* geometry is comparatively new, and is based on the denial of one of Euclid's propositions that parallel lines, if indefinitely extended, will never meet. It has been introduced in Einstein's theory of relativity.

GEORGE I (GEORGE LOUIS) (1660-1727).

The first English king of German birth and speech, George I ascended the throne of Great Britain in 1714, succeeding Queen Anne. He was the son of the elector of Hanover, and through his mother was the great-grandson of James I. Upon the death of his father, in 1698, he became the elector of Hanover, a title he retained all his life. Trained from boyhood for the life of a soldier, George won praise for his conduct in the War of the Spanish Succession. Be-

cause of his relationship to the English royal family, he was made heir to the throne in 1701.

His accession as king of Great Britain and Ireland in 1714 marked the beginning of the dynasty that rules Great Britain to-day. Because of his indifference to England, George allowed many royal powers to fall into the hands of his ministers.

GEORGE II (GEORGE AUGUSTUS) (1683-1760). The son of George I, Prince George Augustus became elector of Hanover and king of Great Britain and Ireland as George II, on his father's death in 1727. He was as little interested in affairs of state as his father, but had the good sense to heed the advice of his able ministers, including Walpole and Pitt. During this reign Canada was added to the British realm, and Clive's victory at Plassey in 1757 assured



Right, Acme



DEMOCRACY'S ABLE ROYALTY
No longer autocrats, England's modern Georges are living symbols of British unity, endowing the humdrum routine of democratic government with "pomp and circumstance." Above, the late George V, Britain's revered monarch during World War I. Right, his son, the late George VI, who ruled throughout World War II.

British supremacy in India. See INDIA.

GEORGE III (GEORGE WILLIAM FREDERICK) (1738-1820). With his mother's advice to "be a real king, George" ringing in his ears, George III took up his duties as ruler of Great Britain and Ireland upon the death of his grandfather, George II, in 1760. Although his education was poor, he was born and brought up in England, and was therefore more popular with the English people than the first two Georges. His chief contribution to English government was to regain for the throne those royal powers that had been lost to the crown through the indifference of his grandfather and great-grandfather, and in so doing he broke the power of the Whig party.

The American colonies were lost to Great Britain through the mistakes of the king and his Prime Minister, Lord North. George III became insane nine years before his death, and during that interval his son acted as regent.

GEORGE IV (GEORGE AUGUSTUS FREDERICK) (1762-1830). Although George IV's reign as king of Great Britain and Ireland lasted for only ten years, beginning in 1820, he had exercised royal powers since 1811, when he began to rule as regent because of George III's mental breakdown. Despite his intelligence and cleverness, he was unpopular with his people because of his misconduct, which is said to have been one of the causes of his father's insanity. His reign was comparatively quiet, and there were few important events. Noteworthy were the effective aid given to Greece in her war for independence by the British, French, and Russian fleets in 1827, and the passage of the Roman Catholic Emancipation Bill in 1829.

GEORGE V (GEORGE FREDERICK ERNEST ALBERT) (1865-1936). Known as the "Sailor King" because of his fondness for the sea and the years which he spent in the navy, George V was one of the most popular rulers.

ers England ever had. Under his wise leadership the country was able to withstand the effects of the World War, in which Great Britain had so important a part.

The second son of Edward VII, George was born in London at Marlborough House. Along with his brother, Albert Victor, who was the heir to the throne, he entered the navy in 1877. After living the life of an ordinary cadet, George was promoted to a lieutenantancy in 1885. Eight years later he was made a captain, and, after a series of promotions, became a vice-admiral in 1903. After the death of his brother, Albert Victor, Duke of Clarence, in 1892, he became heir to the throne and was made the Duke of York.

In the next year he married Princess Victoria Mary of Teck, who had been engaged to his brother. Their six children were Edward, Prince of Wales, born in 1894; Prince Albert, 1895; Princess Mary, 1897; Prince Henry, 1900; Prince George, 1902; and Prince John, who was born in 1905 and died at the age of fourteen.

When his father, Edward VII, became king in 1901, George and his wife traveled around the world, visiting many parts of the empire. Following his return to England, he was made Prince of Wales. Upon the death of his father, May 6, 1910, he became king, and was crowned in Westminster Abbey on June 22, 1911. His success as ruler of the world's greatest empire was due to the fact that he had an excellent background for his work. His experience in the navy, his intensive study of British problems while touring the colonies, and the training received from his father all helped him in ruling Britain in the difficult times during World War I and after.

The chief events during his reign, aside from the war, included recognition, in 1926, of six self-governing dominions as parts of the British Commonwealth of Nations, and the creation of the Irish Free State. The title of the British sovereign in 1926 became "by the Grace of God of Great Britain and Ireland and of the British Dominions Beyond the Seas, King, Defender of the Faith,

Emperor of India." The whole nation mourned when he died in January, 1936. He did much to make strong the office of king in the hearts of his people. He was followed by his son Edward, Prince of Wales, who abdicated after a year's reign in favor of his brother, George VI. See GREAT BRITAIN; BRITISH COMMONWEALTH OF NATIONS; EDWARD VIII.

GEORGE VI (ALBERT FREDERICK ARTHUR GEORGE) (1895-1952). Amid one of the greatest constitutional crises that England has known in modern times, created by the events leading to the abdication of his oldest brother, Edward VIII, George VI came to the throne in December, 1936. He is the second son of George V. When still a boy he was a student at the naval school at Osborne, and later entered the Royal Naval College at Dartmouth, where he was trained for a career in the navy. He became a midshipman in 1913. As a sub-lieutenant, he participated in the Battle of Jutland during World War I. Later he was assigned to the Royal Air Force, in the naval branch.

He became the Duke of York in 1920, and for a time studied at Cambridge. In 1923 he married the daughter of the Earl of Strathmore, Lady Elizabeth Bowes-Lyon. Two children have been born to this couple—the Princess Elizabeth, heir to the throne, and the Princess Margaret Rose.

The coronation of George VI and Elizabeth occurred on May 12, 1937, in Westminster Abbey, London. The colorful pageant that accompanied the ceremony attracted visitors from all parts of the world.

In May, 1939, the king and queen visited the Dominion of Canada. George VI was the first reigning English sovereign to visit the North American continent, and the rulers were everywhere received with great enthusiasm. On their return trip, George VI and Queen Elizabeth paid a brief visit to the United States.

In September of the same year, England declared war upon Germany. During the nearly six years of World War II, King George made several visits to the fighting

fronts. When India became independent, "Emperor of India" was dropped from his title. The royal family toured the British South African territories in 1947.

GEORGE II (1890-1947). Three times made king of Greece, George II first ascended the throne in 1922, on the second abdication of his father, Constantine I. The history of Greece has been a troubled one from the outbreak of World War I. Because Queen Sophia, sister of William II of Germany, and her husband, Constantine I, were pro-German in their sympathies, Constantine was forced to abdicate in June, 1917; his younger son, Alexander, succeeded him.

Alexander died in 1920, and Constantine ruled again for two years. George II became king in 1922, and ruled until a revolution in 1924 forced him into exile. He lived in London until 1935, when the Greek republic was overthrown and the people voted for him to return. His second reign lasted until the German conquest of Greece in 1941; he set up a government in exile in London. Greece was liberated in 1944, but George did not return to Athens until called back by a vote of the people in 1946. He died in 1947 and was succeeded by his brother Paul. See GREECE.

GEORGE, SAINT (?-303). Although it is doubtful whether Saint George ever saw the shores of Great Britain, he was so greatly loved by the crusading knights of England that they honored him by making him the patron saint of their country. It is thought that he was born in Palestine, but no one knows in what year. According to legendary accounts, he went to school in Cappadocia, a region in Asia Minor. There he is said to have spent most of his life and to have been martyred because of his Christian faith. The most exciting story told about him is that of his fight with the Dragon, although this, too, is only a legend. Russia and Portugal also adopted him as their patron saint. Saint George's cross of red is used by the English in their national flag.

GEORGE ELIOT. See ELIOT, GEORGE.



"EMPIRE STATE OF THE SOUTH"

Georgia, largest state east of the Mississippi, has some of the biggest industries in the South, ranks near the top in cotton production.

GEORGIA, jor' ji ah. A mild climate, a variety of fertile soils, and great timber resources make Georgia one of the most favored states of the South. Since the time when it was one of the original thirteen colonies, it has been noted for its production of cotton and tobacco, and today it ranks fourth in the United States as a producer of manufactured cotton goods. Georgia ranks high among the states in the production of fuller's earth and china clay, and is widely known for the quality of its marble, which furnished the building stone for the Corcoran Art Gallery and several state capitols. The largest state east of the Mississippi River, Georgia is appropriately called the "Empire State of the South."

Location and Size. With an area of 58,876 square miles, the state ranks twenty-first in size among the states. One of the South Atlantic states, it has a comparatively small seacoast stretching between South Carolina and Florida, and at its northern end lies



CAPITAL OF A SOVEREIGNTY LARGER THAN ENGLAND AND WALES

The state of Georgia, governed from this building in Atlanta, contains almost 59,000 square miles of rolling land for farming, industry, mining, and winter resorts.

the city of Savannah, one of the nation's important ocean ports. To the north lie Tennessee and North Carolina; to the east, South Carolina and the Atlantic Ocean; to the south, Florida; and to the west, Alabama.

The Surface and the Rivers. Almost all the southern half of Georgia is included in the coastal plain, which is comparatively low land that gently rises from the Atlantic Ocean to the low hills of the Piedmont region. The northern part of the state is composed of uplands which can be divided into four parts: first the Piedmont Belt, which is the largest and the most southern in its location; then the Appalachian Mountains; next the Appalachian Valley; and, in the extreme northwest, the Cumberland Plateau.

The upland region, comprising an area of about 6,000 square miles, is made up of a series of mountain ranges, extending in a northeast-southwest direction, having an

altitude of from 1,000 feet to slightly under 5,000 feet. With its forest-covered hills and valleys, the region is noted for the beauty of its scenery. In the northwestern corner of the state is Chickamauga National Park, surrounded by low mountains; on the famous Lookout Mountain, lying partly in Georgia and partly in Tennessee, several battles of the Civil War were fought.

To the southeast of the uplands are the low hills and broad valleys of the Piedmont Belt, which gradually slopes down to the low and level coastal plain. Along the Fall Line, where the Piedmont Belt meets the coastal plain, there are many rapids or falls in the streams that descend from the mountains to the sea, and many cities and towns are located along this line to take advantage of the water power which these streams furnish. Off the coast are a number of low-lying islands that have rich and fertile soil. In the southeastern corner of Georgia is a part of the great Okefenokee Swamp,

a portion of which is located in Florida.

The rivers of the northwestern part of the state flow down the western side of the mountains into the Tennessee River. To the east and south of this region is a basin drained by the Coosa River, which is formed by the junction of the Oostanaula and the Etowah rivers. To the south lies the valley of the Chattahoochee. This river flows southwest across the state to the western border, where it turns to the south and forms a part of the western boundary. It joins the Flint River, which flows parallel to it for many miles, after it enters Florida, and the united streams form the Apalachicola.

The other important rivers of the state flow to the south and east and eventually enter the Atlantic Ocean. Of these the Savannah and the Altamaha are navigable for a distance of 300 miles. The many mills and factories that are located on these rivers are run by water power.

Moisture and Temperature. In the mountains and hills of the northern part of Georgia the climate is mild and equable; the winter temperatures average about 40° F. The middle portion of the state has a pleasant climate, although it has greater extremes of temperature than the northern sections. Summers are very hot in the coastal region, and winters there are so mild that the area has become a popular vacationland. The average rainfall for the entire state approaches fifty inches, although it is heavier in the mountain regions of the north.

The Products of the Soil. Agriculture is the leading occupation of the people of Georgia, and more than 25,700,000 acres are given over to farming. Because of the variety of soils, almost everything that is raised in other parts of the United States can be profitably grown in Georgia, with the exception of tropical fruits. Cotton, as in the past, is still the most important crop, and the state is first in yield of sea-island cotton, but the farmers are turning more and more to diversified farming as a sounder source of income.

Georgia is a leader among the states in the production of a number of crops, including peanuts, sweet potatoes, watermelons, and pimentos. A high grade of tobacco is raised there, and the annual production totals millions of pounds. In the hilly region of the north there are large pasture lands for the sheep, cattle, and hogs that are raised in great numbers. Apple orchards spread over the foothills, and Georgia is famous for its peaches. Other fruits grown in the state include pears, plums, grapes, and strawberries.

A large number of the farms of Georgia are farmed by tenants, many of whom are Negroes, and most of the work of farming is carried on with simple tools and implements. The problem of the tenant farmers, called share croppers, has been very troublesome for most of the Southern states, including Georgia. The share croppers rent land from the owners, for which they pay with a portion of their crop. The farms are very small, and the small crops bring in an income that is barely enough to live on. Fortunately, the situation is steadily improving. The farmers have been educated in modern agricultural methods through both state and Federal projects, and new implements and techniques have done much to raise the general economic level.

Georgia's extensive forests constitute one of the most valuable natural resources of the state. The trees of the northern sections are mainly hardwoods such as oak, hickory, and maple. In the south the long-leaved pine is the outstanding timber tree. Important logging operations are carried on in the pine forests, and Georgia pine is shipped to every state in the Union, as well as exported to foreign countries. Resin and turpentine from Georgia pine are the basis of a thriving trade in naval stores.

Minerals. Thirty-nine different minerals are found within the borders of Georgia. The most important include kaolin, granite, marble, fuller's earth, limestone, coal, and bauxite, which is the ore of aluminum. Near Atlanta is a huge mass of granite called Stone Mountain, on the face of



U.S.D.A.

THE REAL GEORGIA PEACH—GOOD LOOKING AND DELICIOUS

Peaches fresh from the trees are packed and sent all over the country from packing sheds like this one in Georgia. Peaches are perishable and bruise easily, so the packers have to be both fast and careful in handling this popular fruit.

which are being carved gigantic figures of Confederate soldiers. Georgia marble is noted for its quality and strength, and is widely used as a building and finishing stone. Clays suitable for brick and pottery are found throughout the state and are remarkable for their purity.

Although coal deposits are not large, the semi-bituminous variety is valuable for nearly all purposes. Limestone is quarried in large quantities, and the Sall Mountain mine in White County produces more asbestos than is found in all the other states combined. Small deposits of ammonium sulphate and illuminating gas are found, as well as gold, silver, and copper. Also small quantities of a few precious stones such as amethyst and beryl have been found.

Manufacturing. Georgia, within the present century, has become one of the leading manufacturing states of the South. Based on the large cotton production, the manufacture of cotton goods is the largest

industry in the state. Located for the most part in those cities on the Fall Line where water power is available, there are many mills that produce large quantities of textile goods, hosiery, and other knitted products. There are also a number of mills for the manufacture of woolen fabrics. In the mineral regions of the north there are several iron works. A large number of people are employed in the manufacture of cotton gins and other machinery. The manufacture of lumber products is an important industry, and the production of turpentine and resin is also a leading source of income.

The People and Their Organizations. Georgia ranks fifteenth among the states, with a population of about 3,956,000. A little less than half of the people are Negroes. Atlanta is Georgia's capital and largest city.

The university system, which governs the academic policies of the state, consists of a number of units, of which the most important are the University of Georgia, the

Georgia School of Technology, and the Georgia State College for Women. Religious denominations support several schools for both white and colored students.

The governor and the members of the general assembly, which consists of a house and a senate, are elected for two-year terms.

History. De Soto was probably the first man to explore the territory of Georgia, entering the state in 1540. Jean Ribaut covered most of Georgia in 1562. The present state was part of the original Carolina grant, and in 1733 James Oglethorpe founded a colony at Savannah, which was to serve as a refuge for people escaping from debts and religious intolerance in Europe.

The colony flourished under Oglethorpe's leadership, but rapidly declined after he returned to England in 1743. The original charter was revoked in 1752 and Georgia was organized as a crown colony. By royal proclamation in 1763, the territory was extended to the Mississippi River.

After taking a leading part in the Revolutionary War, Georgia was one of the first states to accept the Constitution. There was a period of unrest following the war, owing to the Indians, and the Federal government in 1838 finally removed the last of the disturbing Cherokees.

Despite the fact that many Georgians favored the Union, the sentiment for secession proved the stronger, and the state seceded in 1861. Many important battles of the Civil War were fought there, and Georgia suffered much from General Sherman's march "from Atlanta to the sea." However, since it was readmitted to the Union in 1870, Georgia has developed into one of the leading states of the South. See ATLANTA.

GEORGIA. Lying at the western end of the saddle region of Transcaucasia, in Asia, is Georgia, an independent republic of the Union of Socialist Soviet Republics. It lies north of Armenia and Turkey, northwest of Azerbaijan, and east of the Black Sea, and is bounded on the north by the principal range of the Caucasus Mountains, the dividing line between Asia and Europe. Georgia has an area of nearly 27,000 square



Underwood and Underwood

THE SOVIET'S LITTLE ORIENT
A bazaar at Tiflis, in Georgia, U.S.S.R.

miles and a population of about 4,000,000.

The country is penetrated by spurs of the Caucasus ranges, and the land consists of mountains, plains, and river valleys. There are heavy forests in the west, but the timber resources have not been developed. Georgia has the world's largest deposits of manganese, which, together with coal, is being mined. Agriculture is the chief occupation of the people, who use primitive methods but raise good crops of cotton, wine grapes and other fruits, tea, and grains.

Tiflis, with a population of about 694,000, is the capital and largest city. Here is located a university established in 1918. Batum, on the Black Sea, is a flourishing petroleum port. It is connected by rail with Tiflis and Baku, on the Caspian Sea.

The Georgians are a fine-looking people of the white race. Their authentic history goes back to the time of Alexander the Great, when Georgia was recognized as an independent kingdom. In the fifteenth century, when the people appealed to Russia for protection against the Turks, Georgia came under the influence of the great Slavic nation, and in 1801 it became a Russian province. In 1918, after the First World

War, the anti-Bolsheviks set up a republic, but in 1921 Georgia adopted a Soviet form of government. In 1922 Georgia, Armenia, and Azerbaijan became autonomous republics of the Transcaucasian Socialist Federated Soviet Republic. In 1936 the three republics became separate units in the Soviet Union.

GEORGIAN BAY. With rocky forested shores and thousands of tiny islands, Georgian Bay, a great arm of Lake Huron, is one of the most popular vacation resorts in the Great Lakes region. Lying completely within the province of Ontario, the bay is fifty miles wide and 120 miles long. It is partly cut off from Lake Huron by Manitoulin Island and a long point of land called Bruce Peninsula. Along the shores of the bay are several important winter shipping ports for Canadian grain.

Georgian Bay is connected with the Bay of Quinte, on Lake Ontario, by the Trent River, the Talbot River, a series of lakes, and the Trent Canal. In 1929 Canada established the Georgian Bay Islands National Park. Included in the park are thirty islands in Georgian Bay, with a total area of about five square miles. The islands make up a beautiful vacationland.

GERANIUM, *je ra'ni um*. Our woods contain several plants which are the true, or wild, geraniums, but the plants which are grown and universally admired as cultivated geraniums generally belong to the genus *Pelargonium*. However, since they are generally called *geraniums*, they are so referred to in this article. The word *pelargonium* means *stork's bill* and refers to the long seed capsules borne by these plants.

The geranium is one of the most popular plants because it is not only successful as a house plant but also as a garden flower. It is not very particular about the conditions under which it lives, and with a little care we may have the geranium in bloom the whole year round. It thrives in rooms which are very hot and dry, provided that it gets some sunshine.

Out in the garden it seems to suit those sections of the country where the summers



WINDOW-BOX FAVORITE

Geraniums brighten many a home, inside and out.

are rather too hot for other plants. To secure the greatest amount of bloom, the geranium should be grown in good soil, but one that is not too rich. When the soil contains too much manure or the plants are in too large pots, they produce quantities of leaf growth but fewer blooms. It is advisable, therefore, to limit the foliage by keeping the plants in small pots.

GERMAN LANGUAGE. Millions of people in various parts of the world, in addition to most of the inhabitants of Germany, speak the German language. Because the language is of world importance, most high schools and colleges in the United States offer courses in German. Scholars find that a knowledge of the language is necessary, for much of the world's fine literature and reports of important scientific discoveries are written in German. In fact, German might be called the language of science.

The German language has had a threefold development. Until the twelfth century, the Old High German was most commonly used. A change then took place, and Middle High German came into most general use for about 400 years. New High German took its place in about the year 1500, and up to the present time it has been the official dialect.

The word "High" is used in a geographi-

cal sense. Early in the history of the language, the dialect of mountainous South Germany was called High German as contrasted to Low German, which was spoken in the plains region of North Germany. Both the Low and High German dialects were spoken throughout each of the historical periods; but since High German is the language of literature, it gave its name to each of the periods.

It is possible to determine in a similar manner the province from which a German native comes, and sometimes peasants from different parts of Germany have been unable to understand one another. Although schools and the printing press have largely done away with these differences in modern Germany, except for a few isolated dis-

tricts, some little peculiarities in the spoken language do exist even today.

The publication of Luther's Bible in the sixteenth century was largely responsible for establishing a common written language in Germany, for it marked the beginning of the New High German period. Luther's Bible was read throughout Germany, and soon people became familiar with its dialect. Writers wishing to reach the largest possible number of readers, therefore, used that dialect. The form of the language was well established by the first German grammar that appeared in 1540, and by other grammars and dictionaries which followed.

GERMAN LITERATURE. See LITERATURE.

Courtesy of Black Star



WEST GERMAN DEMOCRACY IN ACTION
The representatives of the people meet in the Bundestag (Federal Assembly) at Bonn.

GERMANY. This central European country is the homeland of a people who have had a colorful history for centuries, and who have made lasting contributions to science, education, literature, and music. Only after 1871, however, were they united under a single government. Seventy-eight years later the country was divided once more—into the Communist-controlled Democratic Republic of eastern Germany and the Federal Republic of western Germany. In 1914, when the powers of Europe were drawn into a prolonged struggle that all

but exhausted them, Germany was the most powerful nation on the continent. With an area of 208,780 square miles, and colonial possessions covering 1,140,115 square miles, the country was strong, prosperous, and ready for further expansion.

The defeat of Germany, in 1918, led to the abdication of Emperor William II and the fall of the empire. A republic was established under the Weimar Constitution, but this form of government gave way in 1933 to a dictatorship under Adolf Hitler, organizer of the National Socialist, or Nazi, party. Germany had lost about 27,000 square miles of home territory, besides all the colonial possessions, and was



A FAMOUS DYNASTY'S DRAMATIC BEGINNING

In the Middle Ages, Rudolph of Hapsburg was elected Germanic emperor. His house became the Imperial House of the Hapsburgs of Austria. Here he is receiving the news of his election.

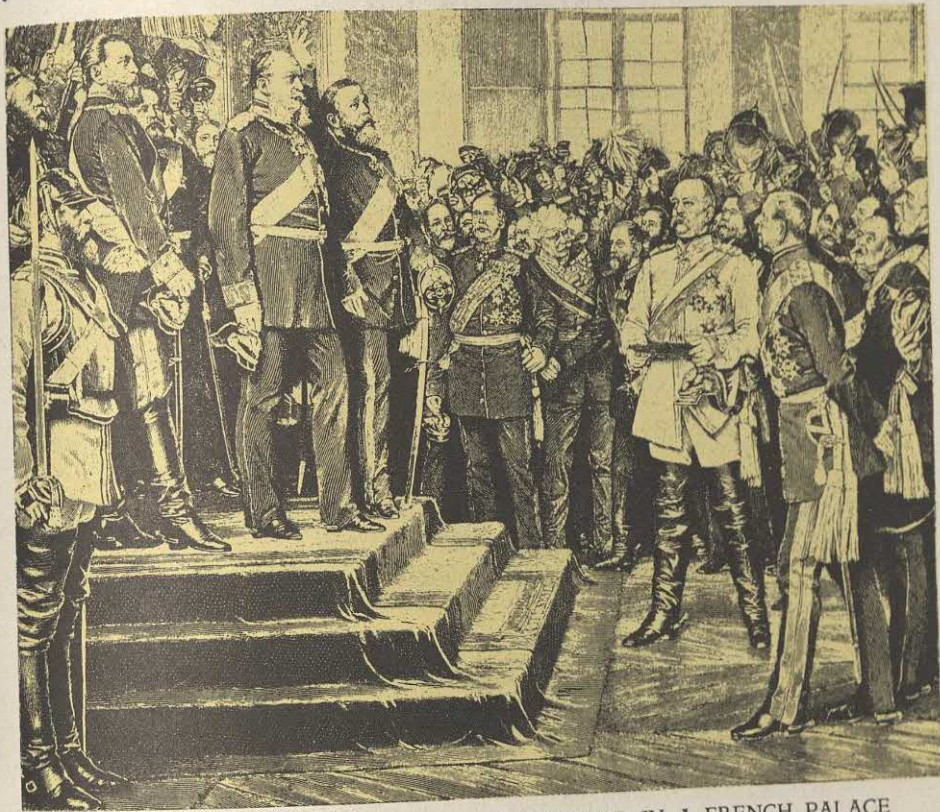
seriously weakened socially, financially, and economically. Because of the depressed condition of the country and the resentment of the Germans over the terms of the Versailles Treaty, Hitler's propaganda won over the great mass of the people, and they permitted him to set up a government that controlled Germany until its defeat in World War II.

Territorial Changes. After World War I, Germany was left with about 180,000 square miles. Alsace-Lorraine went to France, and other blocks of territory to Poland, Belgium, and Czechoslovakia. In 1920; after a vote, part of Schleswig reverted to Denmark. To give the new Poland an outlet on the Baltic, the treaty makers separated East Prussia from the rest of Germany by a Corridor. They

made Danzig and surrounding territory a Free City under the protection of the League of Nations. See **DANZIG**.

Under the aggressive policy of Hitler, Germany expanded again. The Saar Basin, which had been internationalized, was returned peaceably in 1935. In 1938, Hitler annexed Austria and the Czech Sudetanland, and in 1939 seized Memelland from Lithuania, Bohemia and Moravia from Czechoslovakia, and finally Poland, which he divided with Russia. Denmark, Norway, and the Low Countries were seized in 1940; and when France fell in June of that year Germany controlled countries from the North Cape to the Italian possessions in North Africa.

As a result of its defeat in World War II, Germany lost all of its wartime conquests.



THE NEW GERMANY PROCLAIMS AN EMPEROR IN A FRENCH PALACE
At the close of the Franco-German War, in 1871, the German king, William I, was proclaimed emperor of Germany at Versailles, the famous old palace of Louis XIV of France.

Germany today is divided. The Federal Republic of Germany in the west has an area of 95,918 square miles. Its capital is Bonn. The German Democratic Republic (Communist) of the east has an area of 41,645 square miles. Its capital is East Berlin.

Surface and Rivers. Germany's high, rugged mountains in the south slope northward to lower mountains and uplands in the central portion, and finally to the great plain of the North and Baltic Seas. Low ranges of the upland include the Harz, Vosges, Giant, and Ore mountains. The valleys are Germany's fertile farmland.

The Danube River, flowing east, drains southeastern Germany. It is a great river not only of Germany but also of Europe. It is an important commercial river of

several nations. The Ems, Weser, and Elbe are important rivers that flow to the North Sea; the Oder empties into the Baltic. The Rhine, famous for its beautiful banks, is the leading commercial river, and its valley stretches across part of Western Germany. On the shores of the Baltic, these rivers form wide, marshy deltas and shallow lagoons, known as *haffs*. These rivers and a number of smaller ones give Germany many outlets to the sea, and boats carry products to the seaports, where they are transhipped to world markets.

Rainfall and Temperatures. Germany has a temperate climate. Although it is usually colder in the north, the temperatures in the high mountain regions of the south are lower than in other places of the same latitude. However, there is little dif-



German Tourist Information Office

SOUTHERN GERMANY, A LAND OF DIVERSIFIED FARMING

Left: the Bavarian Alps form a picturesque background for haymakers near Garmisch, Upper Bavaria. Right: grape harvesters climb from vine to vine in vineyards near Larch on the Rhine.

ference between the north and the south in summer, and both average below 70° F. The warm winds of the Gulf Stream give to Western Germany temperatures that average higher than those of the eastern section.

Rainfall is heaviest in the southeastern regions and in the Harz Mountains, where the rainfall may average forty inches or more; the average for the whole northern part of the country is about twenty-eight inches.

Farms and Forests. In the misty geologic ages, Germany was swept by a series of glaciers that moved much sand over the plains regions. As a result, the soil is not naturally fertile, and many of the farms have to be heavily fertilized. A large part of the cultivated lands of Germany, which comprise nearly sixty-two per cent of the country's total area, are divided up into small holdings. Agriculture was not well developed until the introduction of farm

machinery and scientific methods of farming. Today, in spite of the poor soil, German farmers, by means of scientific methods and training, are able to harvest large crops.

Among the most important crops are rye, oats, potatoes, wheat, barley, and sugar beets. Crops characteristic of warmer regions are grown in the south. Corn and fruits are valuable crops, and at one time this region led the world in the production of hops. Tobacco is another leading product of South Germany.

Wine that is famous the world over is made from the products of vineyards in the south. Rhine and Moselle wines are named after the river valleys from which they come, and the growing of grapes is the leading occupation of the people of these valleys.

Germany is naturally a heavily wooded country, and large forests are the basis of one of the country's leading industries.

Much of the forested lands has been under government control. So highly valued are the timber resources that forestry as a science is very much advanced. The mountain regions contain most of the important timber lands, of which the Black Forest is the most famous.

Mineral Resources. In a continent that is well supplied with mineral resources, Germany is one of the most richly endowed. Particularly in the mountain regions the country possesses large supplies of coal and iron, which form the basis of Germany's industries. There are also important deposits of lignite, potash, salt, and copper; in addition, smaller deposits of zinc, lead, and petroleum are found. Coal comes from the Ruhr Valley and iron from the Rhineland valleys and the Harz foothills.

Fisheries. The leading fisheries are located in the North Sea and are an important source of income. The Baltic fisheries are also very valuable, although not so large as those in the North Sea.

Industrial development. Germany lost many world markets during World War I, but under the Hitler regime every effort was made to recover them. Before the

outbreak of World War II, which again destroyed the overseas commerce of the Reich, Hitler developed an important barter trade with various countries, exchanging German manufactured products and surplus raw materials for supplies needed by Germany. An ambitious program to promote self-sufficiency also was started.

After World War II a divided Germany set out to rebuild its battered industries. The Saar district in the southwest, with its enormous coal mines and great iron and steel plants, was part of France from 1947 to 1955 when its people voted to return to Germany. It rejoined West Germany in 1957. West Germany benefited from the Schuman Plan, which placed the rich industrial area of southwestern Germany and northeastern France, including Lorraine, the Saar, and the Ruhr, under an international authority. Products of this area, the most important in Europe, are marketed without regard to national boundaries.

In general, despite shortage and restrictions, as well as wholesale removals of industrial equipment by the Russians, both East and West Germany restored their high production rates with amazing speed.

A DIVIDED COUNTRY IN A DIVIDED WORLD

The opposing forces of Freedom and Communism find themselves face to face in Germany.





German Tourist Information Office

GERMAN OUTDOOR MARKET

Housewives bargain for fish in Mölln marketplace, Schleswig-Holstein. In background is 13th century Nikolai church, burial place of Till Eulenspiegel.

In the manufacture of dyes and chemicals, precision instruments, cameras, and optical devices such as microscopes, Germany has a world-wide reputation. Famous, too, are Bavarian glass, porcelain, earthenware, clocks, and carved wooden objects. Toys, jewelry, gold and silver ware, leather, and musical instruments are other typical German products.

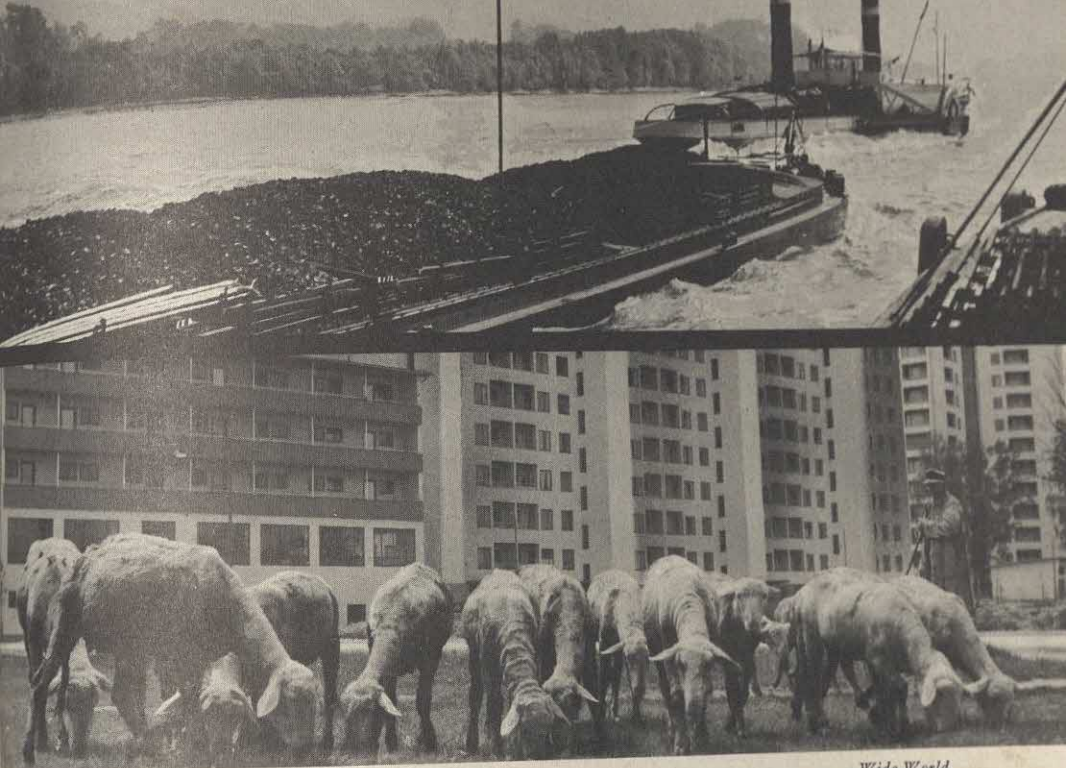
After World War I, Germany faced a shortage of many raw materials essential

to its industrial life. During the intensive program of rearming, this shortage became an acute problem, since the demands of the program gave the armaments factories first call on all supplies. For this reason, German scientists and inventors devoted their ingenuity to developing *ersatz*, or substitute materials. Both paper and glass, for example, were used to make clothing. Synthetic gasoline was developed. Lacking many important articles of diet, and unable to buy foreign products, the Germans also devised many food substitutes.

Trade and Transportation. The manufactured products and raw materials of Germany always found ready markets, and the Germans developed a merchant marine that carried their products to all parts of the world. The export trade that they lost during World War I was partially restored in the years following the war, and was aggressively developed after Hitler came into power. Several new markets were opened in South America by German merchants who settled there. Hitler's barter system was effective in countries with small cash resources.

Although Germany's overseas trade was destroyed by the British blockade in World War II, the Germans carried on an extensive commerce with the neutral countries of Europe. Germany imported grains, raw cotton, dairy products, fruit, oil, wool, iron and copper ores, coffee, and timber. The leading exports normally are coal, iron and steel products, dyes, drugs, paper, glass, leather, and textiles.

The government controlled German railways, inland waterways, and motor highways. The opening of the Midland Canal, in 1938, joined from east to west a network of about 7,000 miles of waterways. Access to the Atlantic from the Baltic was provided by the Kiel Canal. The airport at Tempelhof was the center of air lines leading to many parts of the world. The motor highways, which permitted rapid transport of the mechanized Germany army, later speeded the Allied armies across Germany.



Ewing Galloway

Wide World

COAL AND STEEL BUILD A NEW WEST GERMANY

Germany is a leading coal and steel producer. Above, a long coal barge moves down the Rhine. Below, new apartment buildings of Munich, second city of West Germany.

People and Institutions. Germany went into World War I with a population of over 67,000,000. Minority nationalities numbered over 4,000,000; three fourths of the non-Germans were Poles. The post-war settlements reduced the population to about 60,243,000. German expansion by forcible annexation and conquest brought millions of non-Germans under control of the Reich. The populations of the ceded areas (except Poland) were approximately as follows: Austria, 6,760,000; Czechoslovakia, including the Sudeten area, 3,653,000 (Munich agreement); Bohemia and Moravia (including Silesia), 7,000,000; Memelland, 152,660.

Following the division of Poland between Germany and Russia, there was a

great uprooting of populations, for these two countries agreed upon an exchange of their own nationals. Thousands of Jews and other thousands of German Balts from Lithuania, Estonia, and Latvia were sent to the annexed portion of Poland.

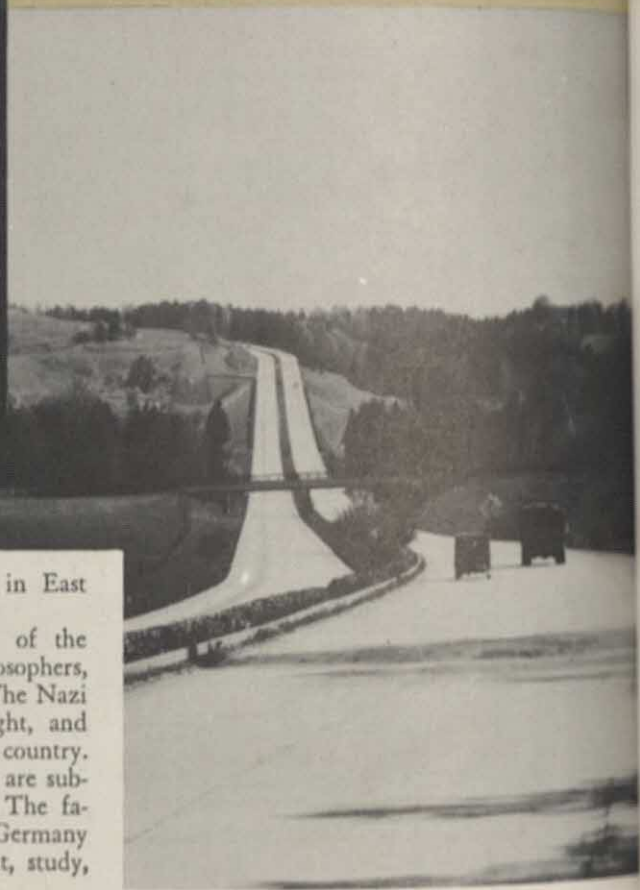
The western Federal Republic of Germany today has about 54,373,000 inhabitants. The eastern German Democratic Republic has 17,833,000 residents. The population of West Berlin, 2,223,000, and East Berlin, 1,122,000, totals 3,345,000 inhabitants. Hamburg has more than 1,760,000 people. Munich, Cologne, Essen, Düsseldorf, and Frankfurt rank next in size. Leipzig and Dresden are famous old cities.

Compulsory education for all children started in Germany, and Germany early had one of the lowest illiteracy rates in the world. Education today is under democratic control in West Germany, and

THE PICTURESQUE AND THE STREAMLINED

Tourists are charmed by Germany's mountain villages and delighted by the efficient highway system that speeds transportation.

From Ewing Galloway, N.Y.



it is under Communist control in East Germany.

Germany has produced some of the world's outstanding scientists, philosophers, poets, musicians, and educators. The Nazi regime stifled freedom of thought, and many intellectual leaders fled the country. Today scholars in East Germany are subject to government supervision. The famous old universities in West Germany are again free centers of thought, study, and research.

East Germany is the stronghold of the Protestant faith, although, as in other countries, the Communists have done their best to suppress religion of any kind. The Evangelical Church unites all Evangelical-Lutheran, Evangelical-Reformed (or Calvinist), and Territorial Churches of the United Confession. There are about equal numbers of Roman Catholics and Protestants in West Germany.

World War II put an end to the Nazi dictatorship set up by Adolf Hitler. The government of the Federal Republic of western Germany is a democratic one, guaranteeing freedom of speech, of faith, and of

assembly. Delegates to the Bundesrat, the upper chamber of the parliament, are appointed by the governments of the states. The people elect the members of the Bundestag, or lower chamber, for terms of four years. The leader of the strongest party in the Bundestag becomes Federal Chancellor. He actually has more power than the President, who is elected by the Federal Electoral Assembly, representing both the Bundestag and the states. The Democratic Republic of eastern Germany has a somewhat similar system but is actually dominated by the Communists.

History. Although tribes of German peo-

ple were active in Europe as early as the time of Alexander the Great, it was not until Julius Caesar became governor of Gaul in 59 B. C. that any direct account of the German tribes came into existence. And it was not until the year A. D. 843, when the Treaty of Verdun was signed, that the tribes were united under one ruler in an independent country. By this treaty the vast empire of Charlemagne was divided into three parts, among his grandsons, and Louis received the eastern portion, in which the Germanic people lived. Under Louis great strides were made in unifying the country; and his son, Charles the Fat, extended the royal power to include France and Italy. This power, however, lasted only a short time, and Charles was deposed by his nephew, Arnulf, when the empire was attacked by the Northmen (887).

There followed a period of several years in which the country was in a state of upheaval due to the invasions of the Hungarians (Magyars) and a series of revolutions carried on by the nobles. In 919 Henry I of Saxony became king of the Germans, and during his reign Germany became a united empire. He succeeded in making peace with the nobles, and, with their help, fortified the country and drove out the Hungarians. Otho I, his son, greatly enlarged the power of the throne by becoming king of Lombardy, in Italy, in 961, and emperor of the Holy Roman Empire in 962. Thus the empire created by Charlemagne was revived on a smaller scale, and it existed for more than 800 years. Otho also succeeded in defeating the Hungarians and driving them out of Germany permanently.

During the next thirty years Germany was unfortunate in having two weak kings, whose neglect of the country led to a state of anarchy. Henry II, the last of the Saxon kings, repaired the damage to some extent. He was followed by a line of Franconian rulers, who, because of interference from the Pope, allowed the power of the throne to diminish to almost nothing. A new era began, however, when Conrad III, the first

of the Hohenstaufen kings, came to the throne in 1138.

At this time the nobles and knights of Europe were engaging in their crusades to the Holy Land, in which two of the German emperors took part. In the last years of the twelfth century, the Hohenstaufen family acquired the kingdom of the Two Sicilies, during the reign of Henry VI. As was the case when Germany controlled Lombardy, the country was neglected for the Two Sicilies, and the power of the crown again declined. Following the death of Conrad IV in 1254, there came a period called the Great Interregnum, in which anarchy reigned in the empire. A small group of powerful princes gained control of the right to elect the emperor, which they did by bribery and corruption. When the last of the Hohenstaufen family died, this group elected both Richard of Cornwall and Alphonso of Spain, but neither was crowned.

Disorder followed until 1273, when Rudolph I was elected emperor. His election marked the rise of the Hapsburg family, members of which ruled continuously in Europe until the First World War. Rudolph captured part of Bohemia, which later was to become part of Austria.

In the century and a half that followed, Germany was largely under the control of the electors, who increased their wealth by giving the crown to the prince who offered them the most money. According to the Golden Bull, issued in the middle of the fourteenth century, four princes and three churchmen were given the power to elect the emperor.

Beginning with Albert II, who came to the throne in 1438, the Hapsburg family held control of Germany for almost 400 years, when they were deposed by Napoleon in 1806. For a long time the Protestants and Roman Catholics were in conflict in Germany. By the Peace of Augsburg in 1555, all the German states were given the right to choose their religion, the choice being between the Lutheran or the Roman Catholic faiths. Although this agreement



German Tourist Information Office

HISTORIC HAMBURG, WEST GERMANY'S LEADING CITY AND PORT

Many small lakes add charm to this famous old town.

settled the trouble for a time, conflict again broke out in the reign of Ferdinand (1556-1564) and continued for fifty years. The climax was reached in the Thirty Years' War, which began in 1618 when the Protestants of Bohemia were asked to accept a Catholic ruler. The war came to an end in 1648 with the Peace of Westphalia.

This treaty was largely responsible for the beginning of the modern period in Germany. The country was divided into about 200 small, independent duchies, ruled by princes who bore no allegiance to the emperor. This situation led to the destruction of national unity; and the states, each acting in its own interest, frequently fought among themselves.

One of the most important results of the treaty was the rise of Prussia, which, under Frederick William, who came to the throne in the middle of the seventeenth century, achieved a position of such power that it dominated Germany up to the time of the First World War. The emperor no longer controlled Germany, and the king of Prussia wielded greater power. By 1756, Prussia's strength was equal to that of all the other German states combined; and when the Confederation of the Rhine was formed in

1806 by a group of German states under Napoleon, Prussia remained independent.

The Congress of Vienna, dominated by Metternich of Austria, met in 1815 to try to straighten out the disorder left by Napoleon's armies. At this time a loose confederation of German states was organized, under which they were to remain independent but were to be headed by a diet, or assembly, in interstate affairs. A customs union, called the Zollverein, was formed in 1830, and its purpose was to establish a certain amount of free trade among the states. It also set up tariff barriers against other countries.

When the Confederation was formed, the state rulers had promised to set up constitutions. However, they ignored their promises until the Revolution of 1830, when the people demanded constitutional government. However, little was accomplished by the revolt. The revolutionary movement that swept Europe in 1848 came to Germany because the rulers had not acceded to the demands of the people for constitutional rights. As a result, a national constitution was written, but its adoption was prevented by conflict between Austria and Prussia.

William I came to the throne in 1861, and in the next year appointed Otto von Bismarck to head the ministry. Under Bismarck, Germany embarked on a course that led directly to the World War. Adopting a policy of "blood and iron," Bismarck set about to unify the country. His first step was to bring about a war between Prussia and Austria, which was caused by a disagreement over the rights to Schleswig-Holstein (see DENMARK). Prussia emerged victorious from the war (1866). Then followed the formation of the North German Confederation (1867), which later became the nucleus of the empire after the southern states joined at the end of the Franco-German War of 1871.

Still working for unification, Bismarck by trickery brought about this war, in which France lost Alsace and Lorraine. The war gave to the states a feeling of national unity, and Bismarck was able to organize Germany into an empire in 1871 with William I of Prussia the first emperor.

With the unification of Germany accomplished, Bismarck then turned to international affairs. His one purpose in his international policy was to isolate France, while enlarging Germany's power. As a part of his policy, he formed the Triple Alliance in 1883, composed of Germany, Italy, and Austria-Hungary; and later a secret treaty was signed with Russia. Thus, with England a neutral country, France stood alone among all the European powers.

However, this situation lasted only a short time; for after Bismarck was dismissed by William II in 1890, the treaty with Russia was allowed to lapse, and Russia immediately joined in an agreement with France. Some historians say that if Bismarck's policy of isolating France had been continued, there would have been no World War I.

A strong foreign policy, which had been begun by Bismarck in 1884, was continued by his successors. The German colonial empire included territory in Africa, Asia, and the Pacific, and also the port of Kiaochow

in Shantung, on the east coast of China.

By 1914 Germany had become a thriving industrial and commercial nation. Proud of their accomplishments, the German people became interested in expanding their empire and in spreading their culture throughout the world. This was their declared purpose when they entered the First World War. In a dispute between Austria-Hungary and Serbia, Germany sided with Austria and declared war on Russia when Russia began mobilizing troops on the Austrian border. This declaration was the beginning of a four-year conflict that proved to be the most destructive war the world had yet known. Germany and her allies were defeated by a coalition including Great Britain, France, Italy, Russia, the United States, and minor powers.

On November 10, 1918, Emperor William II was forced to flee to Holland, although it was not until November 28 that he actually abdicated. The government of Germany was taken over by a Socialist Cabinet under the leadership of Friedrich Ebert. The new government made peace proposals to the Allies, and the Armistice was signed on November 11, 1918. Under the Weimar Constitution, Ebert became the first President of the German Republic in 1919, and held this position until his death in 1925.

Following the Treaty of Versailles, Germany went through an economic depression in which her money became worthless and her trade and commerce sank to a low point. Germany defaulted in the payment of her war debts in 1923, with the result that the Reparations Commission worked out a new plan for debt payment, the Dawes Plan, which became effective in 1924. It was followed by the Young Plan in 1929. These plans provided only temporary relief, however, and Germany at the beginning of the world depression again defaulted on her payments.

When Ebert died, he was succeeded by Field Marshal Paul von Hindenburg. For a five-year period Germany made great steps toward recovering her former posi-



By Ewing Galloway, N.Y.

BIRTHPLACE OF RHINE WINES

A German girl harvests grapes in a hillside vineyard near Wiesbaden on the Rhine.

tion, but the depression destroyed all that had been gained. The Nationalist Socialist party, called the Nazis, under the leadership of Adolf Hitler, gained control of the government in 1933.

Hitler had organized a group of discontented soldiers shortly after the war, and with a program calling for repudiation of the Versailles Treaty and Locarno Pact and the withdrawal of Germany from the League of Nations, had made slow but constant gains in power and popularity. When Hitler took office as Chancellor in 1933, he was voted dictatorial powers for four years. These powers were never given up. Hitler repudiated the Locarno Pact, the Treaty of Versailles, and withdrew from the League of Nations. He began to rearm Germany and vigorously persecuted all who opposed his regime. In 1935, he took German citizenship and property rights from the Jewish people of Germany, and began a campaign against them that led to the killing of more than 6,000,000 of them during World War II. In 1938 and 1939, he seized Austria, Czechoslovakia, and Poland. The seizure of Poland precipitated World War II. After five years of war, the Germans were defeated and the country occupied by the Allies.

The West Germans organized the West German Federal Republic in May, 1949. Konrad Adenauer became Chancellor in that year, and economic recovery proceeded quickly. The Republic is a member of the North Atlantic Treaty Organization and the European Coal and Steel Community. It started rearmament in 1956. In 1954, the Russians made East Germany into a republic. Western powers did not recognize its government. The question of divided Berlin was a constant source of friction between East and West Germany, and between Russia and the West. West Germany has been faced not only with its own economic problems, but also with the problem of providing for more than ten million refugees from East Germany and Communist countries.

Consult the following articles:

CITIES AND TOWNS

Aix-la-Chapelle	Danzig
Augsburg	Frankfort-on-the-Main
Berlin	Hamburg
Blenheim	Nuremburg
	Oberammergau

STATES

Hanover	Prussia
Palatinate	Saxony
	Schleswig-Holstein

HISTORY

Alps	Elbe
Black Forest	Rhine
Danube	Vosges

HISTORY

Augsburg Confession	Hindenburg, Paul von
Bismarck-Schönhausen	Hitler, Adolf
Blücher, Gebhard von	Hohenzollern
Charlemagne	Holy Alliance
Charles V	Holy Roman Empire
Fascism	Hussites
Franco-German War	Luther, Martin
Frederick I (Barbarossa)	Napoleon III
Frederick II (the Great)	Nazism
Frederick William	Reformation, The
Frederick William I	Seven Weeks' War
Free Cities	Seven Years' War
Hanseatic League	Succession Wars
Henry III	Thirty Years' War
Henry IV	Triple Alliance
Henry VI	William I
Hessians	William II

World War (I, II)

GERMINATION, *jur mi na' shun*. The stages through which a seed passes in

changing into a plant make up a process which we call germination. To bring about this development, there must be present the proper amount of warmth, moisture, and oxygen. A shortage or excess of these factors will cause a seed to lie dormant or to decay in the ground.

Every seed contains three elements. Of most importance is the *embryo*, or tiny plant, which must break through the seed before growth actually begins. The second is the seed coat, which protects the embryo and keeps it from drying out. The third item in each seed is the nourishment, which is stored in the endosperm.

Under proper conditions of moisture, heat, and oxygen, a seed planted in the ground will soon begin to absorb moisture and will swell. At the same time, oxygen is absorbed, and the starch within the seed is changed to sugar and dextrin in soluble form for use by the plant. These activities within the seed are accompanied by an increase of temperature, and within a few days the seed bursts open, the sprout or plumule coming forth. This plumule always starts growing downward, then suddenly turns upward; and at the bend a second shoot, the rootlet, appears. The plumule continues growing upward; the rootlet begins a downward growth, pushing out small, hairlike feelers into the earth, through which the growing seedling draws its food and water from the earth.

GERMS. Found in air, water, plants, and animals, germs are micro-organisms that are the cause of infectious diseases.

For additional information see BACTERIA AND BACTERIOLOGY; GERM THEORY OF DISEASE.

GERM THEORY OF DISEASE. Scientists have discovered that throughout nature, in the air, in water, and even in the bodies of people and animals, there are millions of tiny, active organisms which live, multiply, and die in endless succession. These tiny organisms have been called bacteria, microbes, micro-organisms, or germs. They are divided into several classes, including: the *protozoa*, or animal organ-

isms; the *bacteria*, or plant organisms; and the non-filterable *viruses*, organisms so small that they cannot be seen through an ordinary microscope.

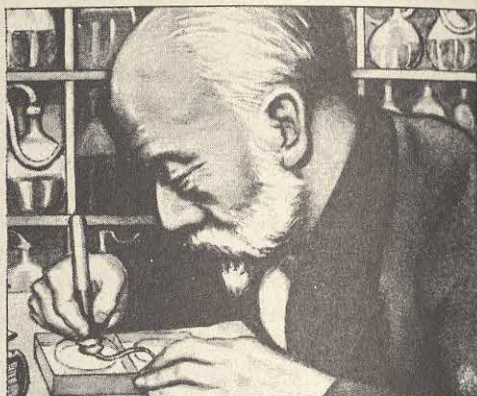
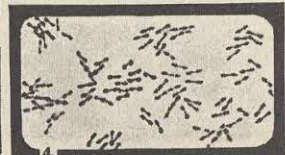
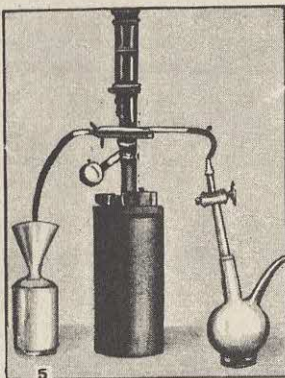
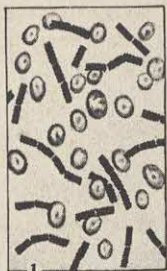
According to the germ theory of disease, micro-organisms, when taken into the human body, sometimes find conditions favorable to their growth; and they multiply and develop and produce certain diseases. These germs are constantly present, but in a healthy system they remain inactive because the body is constructed to resist them under ordinary circumstances.

According to the germ theory, there are certain types of germs which cause diphtheria and others which cause cholera. In fact, each disease is caused by a specific germ. Robert Koch, a German physician, was a pioneer in the study of bacteriology, and through his experiments he was the first to demonstrate that many diseases are caused by specific germs. He published his first report on his experiments in 1876, and later other scientists, including Pasteur, proved that his germ theory was correct.

In 1882 Koch discovered the bacillus of tuberculosis, and several years later announced that he had discovered a substance that would destroy it. The substance does not cure tuberculosis, but is helpful in diagnosing the disease in animals. In 1883 Koch was sent by the German government to Egypt and India to investigate the cholera epidemic there. As a result of his experiments, he discovered the bacillus that causes cholera.

By using the methods and appliances that Koch invented for work in bacteriology, scientists have since shown that almost all infectious diseases are caused by a particular germ, which must be present in the body to produce that disease. Such infectious diseases as typhoid fever and pneumonia and scarlet fever are caused by different species of bacteria. Measles and polio are known to be caused by viruses. Of course, identifying the cause of a disease does not always provide a cure.

The discoveries of Koch and those who came later have been among the greatest



Courtesy Hygeia Health Magazine

THE WORK OF MICROBE HUNTERS

Robert Koch (above) and Louis Pasteur were among the first to prove that diseases are caused by microbes. (1, 2, 3, and 4) Microscopic views of disease germs. (5) Retort used by Pasteur.

contributions to the welfare of mankind. For by their work it is now known how to cure and even prevent many diseases. Even though there is little known about the germs of some infectious diseases, the germ theory has shown the way in which they spread, and has led to the discovery of means by which they can be arrested.

GERRYMANDER. In 1812 Elbridge Gerry, the governor of Massachusetts, concocted a system of rearranging senatorial election districts so as to favor his party, and this system became known as a gerrymander. Gerry was a Republican, and he so juggled the election districts that Federalist majorities were lumped in certain localities, thus reducing that party's bloc in the legislature. One district looked on a map so much like the outline of a salamander that *gerrymander* was coined in derision of the governor.

In spite of this dubious political scheme, Gerry (1744-1814) is remembered as an able statesman. A native of Massachusetts, he was educated at Harvard, and was a member of the Continental Congress of 1776. Later he attended the Constitutional Convention, but he refused to sign the document because he did not approve of it. Gerry was elected to the first Congress by the Anti-Federalist Party in 1789, and in

1797 he was sent to France to establish diplomatic relations with that country. He was elected governor of Massachusetts in 1810, and was elected Vice-President of the United States in 1812. He died in office.



THE PRAYER IN GETHSEMANE

GETHSEMANE, *geth sem' a ne*. The olive grove in which Jesus suffered and prayed on the night before His crucifixion is called Gethsemane. According to the Gospels, the spot was a favorite with Christ and His disciples. Near the Jerusalem of today there is a walled enclosure about 150 feet square which is believed to be Gethsemane. In it are some very old olive trees said to have been there in the time of Christ.

GETTYSBURG, BATTLE OF. Fought on July 1-3, 1863, the Battle of Gettysburg was the turning point of the Civil War. It was the disastrous end to Lee's second and last invasion of the North. It gave confidence to the Northern troops, and it brought security to the people above the Mason-Dixon Line, for they knew that Lee could not menace their territory again.

During the spring of 1863 Lee had decided to attempt an invasion of the North. He had been victorious at Fredericksburg in December, 1862; the people of the Union were discouraged; and Lee's move seemed a strategic one. Lee advanced through Maryland, crossed the Blue Ridge Mountains, and went up the Shenandoah Valley into Pennsylvania. The Federal troops under General Meade followed, and the two forces met at Gettysburg on July 1. The Union Army occupied Cemetery Ridge to the south of the city; the Confederates fortified Seminary Ridge, to the west. The next day the Southerners attacked and nearly drove out the Northerners; as night fell, the Union army had been driven back on the right and left.

On the morning of July 3, Pickett, of the Confederate army, led a charge against the center of the line; he was driven back, and the North regained its lost positions. Lee began his retreat after a loss of 2,592 men killed, 12,709 wounded, and 5,150 captured or missing, out of his total force of about 75,000. Meade, however, failed to pursue him. The Union loss was 3,072 killed, 14,497 wounded, and 5,434 captured or missing, out of a force of about 82,000. See **CIVIL WAR IN AMERICA.**

GETTYSBURG ADDRESS. When President Abraham Lincoln dedicated the National Cemetery on the battlefield of Gettysburg, November 19, 1863, he said, "The world will little note, nor long remember, what we say here." But the world did note and will always remember what the martyred President said, for his Gettysburg Address, containing only 267 words, is numbered among the greatest speeches of all time. Lincoln did not prepare the

address until he was on the train going from Washington to Gettysburg; then he wrote it on the back of an envelope:

Four score and seven years ago, our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But in a larger sense we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The brave men, living and dead, who struggled here, have consecrated it far above our poor power to add or detract. The world will little note, nor long remember, what we say here, but it can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that government of the people, by the people, for the people, shall not perish from the earth.

GEYSER, *gi'zur*. One of the foremost attractions of Yellowstone National Park in the United States is Old Faithful geyser, a spring that about every hour shoots forth a stream of hot water and steam. In this area there are numerous other geysers, some small, others large. Their eruptions, too, vary greatly in frequency and duration of time.

The funnel-shaped geyser opening is usually surrounded by beautiful and colorful formations caused by deposits of minerals brought up by the water. The phenomenon probably is produced by hot water being forced up through the earth under the pressure of steam. It is believed that, as the opening of the funnel gradually fills with water, the pressure at the bottom of the column becomes very great, causing the water, surrounded by hot rocks at the bottom, to reach a high temperature. As



Union Pacific Railroad

WORLD'S MOST-FAMOUS GEYSER

Old Faithful spouts with clocklike regularity

the temperature increases, steam forces its way up, throwing the water in the funnel sometimes to a height of several hundred feet into the air.

Geysers are considered to represent the last stage of volcanic activity. Where they are found, the rocks may still be not far below the surface. After an eruption, water again fills the crack, and when sufficient steam has been formed, the eruption is repeated. As the rocks gradually cool, the geysers will erupt less and less frequently, finally ceasing altogether. Some have already ceased, while in other places new ones have developed.

Other than Yellowstone Park, the major geyser regions of the world are found in Iceland and New Zealand. The largest gey-

ser in the world appeared in New Zealand for the first time in 1904. See YELLOWSTONE NATIONAL PARK; BOILING POINT.

GHANA, *gah' na*, an African republic in the British Commonwealth. It was formed from the British Gold Coast colony and the trusteeship of Togoland. It faces the Gulf of Guinea, and is also bounded by the republics of Ivory Coast, Upper Volta, and Togo. Its main river is the Volta. It became a republic July 1, 1960. Its area is 19,843 square miles, and its population is about 4,836,000. Its capital is Accra. It had been self-governing since 1957.

GHENT, *gent*, TREATY OF, ended the War of 1812 between England and the United States. It was signed December 24, 1814, in Ghent, Belgium. The treaty settled the ownership of a few northeastern fishing islands and provided for commissions to settle boundaries between Canada and the United States. The treaty did not settle the issues which had caused the war: impressment of American seamen, fishing rights in Newfoundland waters, and rights of neutral nations. See IMPRESSMENT OF SEAMEN; NEW ORLEANS, BATTLE OF; WAR OF 1812.

GHOSTS. Mysterious noises in the gloom of the night, a specter of white advancing on the stairs, an unearthly whisper, an unexplained gust of wind—all of these we associate with ghosts. Do they really exist? The world has often wondered, and even scientists have speculated on the possibility of the dead returning and making their presence known to the living.

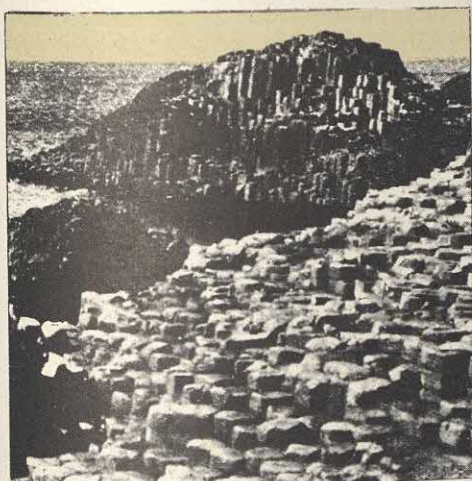
Of course, most things we think we hear and see in the dark, especially in empty houses, can be easily explained; but there have been occasions that have mystified even the most realistic of men. The belief in ghosts has long been a deeply rooted instinct. It is said that the custom of placing stones over graves was based on the belief that if it were not done, the ghost of the dead person would arise and haunt the neighborhood. See TOTEM; WITCHCRAFT.

GIANTS, ji'ants. In fairy stories like *Jack and the Beanstalk*, and legends like those of Paul Bunyan and John Henry, we read of huge men, known as giants. Real giants, however, are not quite so big, rarely reaching over eight feet in height, and certainly not capable of all the prodigious feats of the story-book giants.

Maximinus, a Roman emperor, for instance, was said to have been nearly nine feet in height; Patrick Cotter, who lived in the eighteenth century, eight feet, three inches; Chang-wu-gon, of China, seven feet, nine inches. Robert Wadlow, of Alton, Ill., is said to be the tallest living giant, towering eight feet, eight inches.

Giants usually are born of perfectly normal parents. Abnormal gland activity, however, causes them to grow very tall, and, unless the growth stops at an early age, they become tall enough to be called giants. The condition is *giantism*. See GLANDS.

In Greek and Norse mythology, giants were personified forces of nature, and sometimes Greek giants were portrayed as normal, but extremely strong men.



HONEYCOMB OF STONE

The geometric stones of the Giant's Causeway.

GIANTS' CAUSE'WAY. On the northern shores of Ireland, facing Scotland, can be seen this unusual natural formation, extending for about 900 feet into the sea. It is comprised of the flat tops of many

thousands of basaltic columns, usually hexagonal in shape, varying from fifteen to twenty inches in diameter, and fitted closely together. This remarkable structure is divided into three sections, the Little Causeway, the Middle, (or Honeycomb) Causeway, and the Grand Causeway. The columns form various shapes and arrangements which have been likened by the natives to well-known objects, such as the *Wishing Chair*, the *Giants' Loom*, the *Giants' Well*, and the *Lady's Fan*.

The name is derived from an ancient tale about a group of giants who started to construct a road from county Antrim to Scotland.

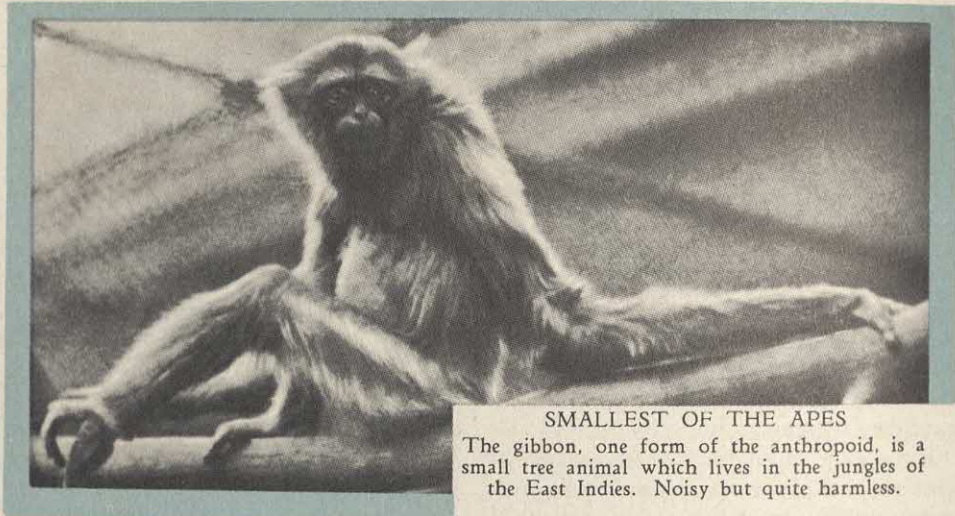
GIB'BON. Swinging from limb to limb or gathering in chattering groups in the trees of India and Malaysia, these small, tailless anthropoid apes pierce the air with their shrill cries. Their arms are strong and of great length, extending almost to their ankles, but, in unusual contrast, their legs are short and weak. The body is slender and usually black, and is peculiarly relieved by the white or gray beard, resembling a mask, which encircles the face. One species has white hands as well. Although they do not adapt themselves very well to life in captivity, gibbons form an interesting addition to a zoo.

GIBBON, EDWARD (1737-1794). *The Decline and Fall of the Roman Empire*, written by the British historian, Edward Gibbon, is considered the finest survey of Rome ever produced, and has gained for the author recognition as one of the greatest historians since Herodotus. Because of Gibbon's poor health, his early formal education was confined almost entirely to reading books. At fifteen he entered Oxford, but after a little more than a year was withdrawn by his father because he had adopted the Roman Catholic faith. His father then sent him to Lausanne, Switzerland, to study, where he was converted to Protestantism again by a Calvinist minister.

In 1761 Gibbon published his first literary venture, an essay on literature written in French. Three years later, during a visit to

Italy, he conceived the idea of writing a history of Rome. It was twelve years before the first volume was published, in 1776, and the sixth and final volume appeared in 1788. The work covers about thirteen centuries of Roman life, down to the fall of Con-

stantinople. Probably because of religious prejudices, Gibbon failed to give due justice to the part played by Christianity during the period. This omission has occasioned some criticism of his monumental work. Gibbon also wrote an autobiography.



SMALLEST OF THE APES

The gibbon, one form of the anthropoid, is a small tree animal which lives in the jungles of the East Indies. Noisy but quite harmless.

GIBRALTAR, *jib rawl'tur*. Towering high into the air stands this natural marble fortress, gateway to the Mediterranean and defender of British interests in the Near East. For centuries it has been the target of conquerors who fully realized that the phrase "strong as the Rock of Gibraltar" was no idle boast. Its sheer, almost perpendicular, face rises nearly 1,400 feet above the sea on the southern shore of the Iberian or Spanish peninsula, facing Morocco in Northern Africa. Since the Peace of Utrecht, in 1713, it has been strongly fortified by Great Britain with powerful batteries of guns capable of withstanding assaults from all sides.

Gibraltar appears in Greek legends as one of the "pillars of Hercules," but Tarik ibn Zaid, a powerful Berber of the early eighth century, was the first to fortify it as a stronghold. Long afterward it was known as the "Rock of Tarik" and was securely held by the Moors of Northern Africa. In 1309 it was taken by Spain, but again fell into the hands of the Moors and did not

again become Spanish territory until 1462, when it was captured in a seemingly impossible assault. A combined Dutch and English army wrested the rocky promontory from the Spaniards in 1704; but Spain, with the aid of France, sought, unsuccessfully, to secure its return in a four-year siege beginning in 1779.

Between the rock and Spanish soil lies a low, sandy strip of neutral territory a mile wide, from which the north face of the rock rises abruptly. Approach from the sea is well-nigh impossible from the east and south; and the west side, which slopes less steeply down to the sea, is well fortified. Large caverns and ledges have been cut into the rock, with portholes every twelve yards. Armaments of the latest design guard the fortress, and both military and naval forces are stationed there.

On the rocky shores of the western slope lies the town of Gibraltar, facing the bay. It is a free port, and its rather large shipping trade is, in the main, conducted along one wide street, extending for about a



BRITAIN'S KEY TO THE MEDITERRANEAN—THE ROCK OF GIBRALTAR

Bristling with modern heavy artillery, Gibraltar stands guard at the narrow gateway to Britains "life line" eastward. It is believed to be practically impregnable.

mile. There is no important industry. The commander in chief of the armed forces of Gibraltar also serves as the governor of the town, which has a population of 25,000.

GIBRALTAR, STRAIT OF. Joining the Atlantic Ocean and the Mediterranean Sea, this channel separates Southwestern Europe from Africa. At the narrowest point, just west of the British-fortified Rock of Gibraltar, it is eight and a half miles in width. Into the Mediterranean, along the middle of the Strait, flows a strong current. However, the two lateral currents and the under current move in the opposite direction. Through the strait sails the commerce of the Western World to Southern Europe, Northern Africa, and Near Asia.

It thrives very well in captivity. An unusual feature of this animal is that food is stored in the tail.

GILBERT, HUMPHREY, Sir (about 1539-1583). Misfortune dogged the footsteps of Sir Humphrey Gilbert, a member of the gallant group of navigators and explorers who wrote an adventurous story in the life of sixteenth century England. He was a stepbrother of Sir Walter Raleigh. After years of able military service, Sir Humphrey set out in 1578 to find a new north-west route to India, but returned in 1579 after an unsuccessful venture. Again in 1583, with a fleet of five ships, he led an expedition to America. Skirting the shores of Newfoundland, he set up the first Brit-



LETHAL LIZARD GIANT
The Southwest's Gila monster, the only poisonous lizard in America.

GILA, he'lah, MONSTER. The "bogey" of the desert, the bright-colored Gila monster is a poisonous lizard living in Texas, Arizona, and New Mexico. It has a forbidding appearance, and its bite is often fatal to small animals and birds, although not particularly dangerous to man. One of the largest lizards in North America, the Gila is about two feet long, with a broad tail and sharp, grooved teeth. Its beadlike scales are orange and deep black.

ish colony in North America near Saint Johns. Then, with three of the vessels, he started to explore the coast, but lost one ship and headed for England again. On the return voyage, he lost his life in a terrific storm that wrecked his ship.

GILBERT, WILLIAM SCHWENCK (1836-1911). Even though his work was done some years ago in collaboration with Sir Arthur Sullivan, the musical comedies of William S. Gilbert are still popular today.

Gilbert wrote the stories and the verses of the songs, and Sullivan composed the music.

Gilbert began working with Sullivan in 1871, after he had spent some years in government service following his graduation from London University. He had also spent some time in writing humorous verse and plays before he worked with Sullivan. For more than twenty-five years, Gilbert and Sullivan continued their partnership. During that time they produced many comedies, the most popular of which are *H.M.S. Pinafore*, *The Pirates of Penzance*, and *The Mikado*. These musical comedies have been produced many times in the United States, and they are still loved by theater audiences. The Gilbert and Sullivan partnership continued until Sullivan's death in 1900.

Although Gilbert's works masqueraded as nonsense, they were full of literary and social criticism and often satirized public life in England. For example, *Pinafore* mocks the British navy, and *Iolanthe* ridicules the English peerage.

GIL'EAD. The part of the Promised Land given to the Israelite tribes of Reuben, Gad, and Manasseh was called Gilead. It included a poorly defined mountainous region east of the Jordan River, extending from Galilee to the Dead Sea. During all Israelite history, Gilead was a place of refuge for people who were in difficulty with the ruling powers west of the Jordan (*Numbers XXI*, 21). It served as a hiding place for Absalom when he fled from his father, King David; and for David himself, when Absalom rebelled.

A resin or "balm" gathered from a small evergreen tree of this region was the "balm of Gilead" referred to in the Bible.

GILLS. Animals which live their full lives under water are equipped with gills, instead of a nose and lungs, for breathing. The gills of most fish are composed of bone and cartilage in the form of arches located just back of the head. The inside of the gill is covered with fringed, plumelike fibers which are blood red in color.

As water enters the gills through the mouth, it passes through this plumelike growth, which extracts the oxygen from it. Crustaceans, amphibians, and mollusks all have gills during the portion of their lives spent in water. See **AMPHIBIANS**; **FISH AND FISHERIES**.

GINGER, *jin'gur*. The properties of the herb we know as ginger are so well known that its name is used to describe personal traits. We speak of acting "gingerly" when we are extremely careful, as we would be in tasting ginger. And it is common to say of a man that he lacks "ginger" if he is languid and easygoing. In ginger ale and ginger beer and ginger tea, ginger cookies and ginger bread and ginger "snaps," the taste and tang of ginger are familiar to us all. Most of us know it, too, in candied and preserved ginger. The last feels so hot in the stomach that Chinamen eat it before going out of doors on a bitterly cold winter day.

Our best ginger today comes from Jamaica and Porto Rico, and large quantities are imported from Sierra Leone, in Africa, and from India and Japan. It is native only to tropical Asia, however, and has been raised there for the European market so many hundreds of years that it is found mentioned in tariff lists of the second century. Japanese ginger is very mild.

The ginger plant grows from an underground stem, or rhizome. The leaves, which grow to a height of three feet, are on a different stalk from the flowers. The leaves grow up and spread before the flower stalk starts. If the ginger is not harvested sooner, the stalks wither after the flower.

GINGHAM, *ging'am*. Said to be named from a Javanese word meaning *fading*, or possibly from *Guingamp*, a town in Northern France where goods of this kind were manufactured, gingham is a stout, lightweight, reversible, all-cotton fabric, woven of white or colored yarns in stripes, plaids, or checks, and stiffened with starch. It is used for dresses, skirts, and waists, and various household purposes.

GINSENG, *jin'seng*. Long ago, no human dared gather ginseng, a root believed to be of great value in treating certain diseases. This root sometimes looks like a man, and superstitious people believed that it was human. They also believed that when the plant was pulled up, the man in it died with a horrible scream, which would strike any hearer dead. Thus, animals which were not affected by the screams were used to gather the root.

Ginseng is widely used in China as a medicine. A small part of the supply is grown in Manchuria and Korea, but most of it is imported from the United States. The plant is native to Canada and the Northern states from the Mississippi River to the Atlantic, and is also widely cultivated. Both the wild and cultivated varieties are exported, but the cultivated ginseng brings higher prices. The plant grows best in light soil which contains humus, potash, and phosphoric acid. It must be protected from the sun's rays, and takes about six years to mature.

GIORGIONE, *jawr jo' nay* (GIORGIO BARBARELLI) (about 1478-1510). In the opinion of Giorgione, art should appeal by means of beauty and mood. The work of this great Venetian painter of the Renaissance is unsurpassed, even by Leonardo da Vinci's, in charm and grace. Idea and detail, which many consider of utmost importance, are given little attention in his masterpieces.

A native of the village of Castelfranco, Giorgione early went to Venice and studied under Giovanni Bellini, becoming identified with the Venetian School. Among his better-known pictures are *Christ Bearing the Cross*, now owned by an American; *The Family of Giorgione* (in Venice); *The Concert*, which is housed in the Pitti Palace in Florence; and the lovely *Sleeping Venus* (Dresden), one of the finest products of the Renaissance.

GIOTTO, *jo'toh* (GIOTTO DI BONDONE) (1267?-1337). Because he brought realism and life to an art that for centuries had been stiff and unnatural, Giotto has been

respected by every artist since his time. His chief purpose was to bring nature to art not only in his figures but also in color; and although his work, when compared to later painting, appears immature, he freed art and architecture from the chains that bound them during the Dark Ages.

Giotto was born in the little village of Vespignano, near the city of Florence, Italy. He showed artistic talent when he was a small boy, and Cimabue, a famous artist of the day, was so attracted by his ability that he made Giotto his pupil. He soon became the leading artist in Italy, and his work in designing and sculpturing also attracted wide attention.

His earliest works were frescoes depicting the life of Saint Francis, at Assisi. That his powers as an artist increased is seen in his series of the *Life of Christ*, and the *Life of the Virgin*, and his *Allegories of Saint Francis*. His greatest work is considered to be the *Life of John the Baptist*. He was also a noted architect. In 1334 he designed the Florentine cathedral and its Campanile, known as Giotto's Tower, which was considered his architectural masterpiece.

GIP'SY. See GYPSIES.

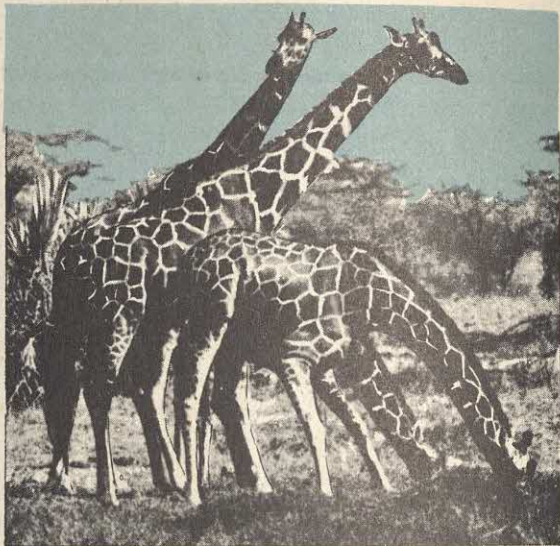
GIRAFFE, *ji raf'*. Probably a giraffe can best be described by calling it a "neck on legs," for this comical native of Africa is the tallest animal in the world, often reaching a height of eighteen to twenty feet. Formerly called a *camelopard*, it resembles the camel in build and the leopard in its spotted skin.

The most unusual thing about the giraffe is, of course, its long neck. Another peculiarity is the fact that the animal has no voice. Upon the giraffe's camel-like head are two bony extensions resembling horns. Because of the long unwieldy neck, the animal can feed upon grass only by spreading its forelegs wide apart, a sight that greatly amuses children watching the animal eating in a zoo. Its immense height enables it to feed easily on the leaves of trees. Tan-colored with dark spots, it is unusually mild-tempered and, in captivity, is often gentle and playful. In the wild



LEAF-EATING GIANTS

Giraffes have long necks, and so they can reach the choice greens to be found high in trees. But if there are no trees, eating becomes awkward indeed (above). Right, a giraffe family at home.



state, however, it defends itself against its greatest enemy, the lion, by kicking viciously.

GIRL SCOUTS. The Girl Scouts of the United States of America is an organization of approximately 2,000,000 girls and grownups whose purpose is to provide a leisure-time program for girls between the ages of seven and seventeen and to help them be better citizens and happier, more resourceful people. The organization was chartered by Congress in 1950.

The Scouting movement is a partnership of girls and adults. The vast majority of the adults are volunteers, while a small group are paid professional workers with special skills. Much of the strength of the Girl Scout organization derives from the fact that responsibility for the movement rests primarily with volunteer workers.

Girl Scouts wear woods-green uniforms, and their insignia and pin are a gold trefoil emblazoned with an American eagle and the monogram GS. The trefoil, and the Girl Scout sign, which is made by three fingers of the right hand extended, with the thumb holding down the little finger, represent the threefold promise all Girl Scouts make: "To do my duty to God and my country; to help other people at all times; and to obey the Girl Scout Laws."

The Laws are:

1. *A Girl Scout's honor is to be trusted.*
2. *A Girl Scout is loyal.*
3. *A Girl Scout's duty is to be useful and help others.*
4. *A Girl Scout is a friend to all, and a sister to every other Girl Scout.*
5. *A Girl Scout is courteous.*
6. *A Girl Scout is a friend to animals.*
7. *A Girl Scout obeys orders.*
8. *A Girl Scout is cheerful.*
9. *A Girl Scout is thrifty.*
10. *A Girl Scout is clean in thought, word, and deed.*

The Girl Scout motto is "Be Prepared."

Through Girl Scouting girls have an opportunity for fun and adventure, for giving service to others, and for becoming active members of a group. Any girl who subscribes to the Promise and Laws may become a Scout, regardless of her race, creed, or national background. Girl Scout troops are organized under a local council or, in places where there is no council, under a Lone Troop Committee. Each troop has at least one adult leader and a minimum of eight members. The national organization maintains the Edith Macy Training School, near Pleasantville, N. Y., where conferences for leaders are held and training courses are given. Other leader



PREPARATION FOR LIFE

Girl Scouts are a credit to the nation. In the process of having a wonderful time, they sew, cook, care for children, exercise in the open air—and thereby prepare to become healthy, helpful citizens, good homemakers, and wonderful mothers.



GIRL SCOUTS AID THE UNFORTUNATE, HELP THE HELPLESS

To the very old and the very young, those who are sick or poor or alone, the Girl Scout is quick to offer a helping hand. She also remembers her friends of the out-of-doors and makes sure that they do not go hungry when snow blankets the earth.

training is given throughout the country.

To help girls develop individually and yet learn to work with each other, most troops use the "patrol system." The troop is divided into small groups, each of which chooses its own patrol leader. Each patrol leader is responsible for representing her group at the "Court of Honor," when all patrol leaders and the adult leaders make plans for the troop. The patrol system makes a Girl Scout troop a representative democracy in miniature.

Girl Scouts are divided into three groups: Brownies, 7-10; Intermediate Scouts, 10-14; and Senior Scouts, 14-17. The Girl Scout program includes eleven major fields of interest: agriculture, arts and crafts, community life, health and safety, homemaking, international friendship, literature and dramatics, music and dancing, nature, out-of-doors, and sports and games.

Brownie Scouts find and develop their abilities by learning to do things well so they will be prepared to do them in the right way at the right time; "doing a good turn daily"; working together; becoming useful citizens of their community. Intermediate Scouts may progress from Tenderfoot to Second Class Rank and then, through earning proficiency badges, ac-

quire skills and learn to work with others. The badges are a source of ideas and a symbol of preparedness for service. Each badge signifies a new skill learned, and an Intermediate who has earned twelve badges becomes a First Class Scout. After this she may progress to the Curved Bar Rank. Intermediate Scouts earn over a million badges a year, with Homemaking traditionally the most popular activity. Senior Girl Scouts have opportunity for vocational exploration, co-ed activities, and special programs such as sailing, aviation, conservation, outdoor activities, radio, and dramatics.

By the very nature of the Promise and Laws each Girl Scout is pledged to service. The Girl Scout program emphasizes the value of simple outdoor living; as part of this program four types of Girl Scout camping are available—day camps, trip camps, established camps, and troop camps.

The Girl Scouts of the U.S.A. are part of the World Association of Girl Guides and Girl Scouts, to which some thirty countries belong, all following the same Laws and Promises and ideals of Scouting. In 1932 Our Chalet, world meeting place of Girl Guides and Girl Scouts, was opened at Adelboden, Switzerland. In the United

States the Girl Scouts have set up the Juliette Low World Friendship Fund in memory of their founder. Money from this fund, which is contributed by Girl Scouts, helps to make possible an international exchange of Scouts and leaders, aid to new Scout movements in other lands, annual encampments at Our Chalet, and other projects. An International Post Box is maintained at the Girl Scout National Headquarters in New York City to arrange correspondence between Girl Guides and Girl Scouts in different lands.

February is International Month in the Scout calendar, and February 22, birthday of both Lord and Lady Baden-Powell, is observed as International Friendship Day (Thinking Day) by Scouts around the world. A major Girl Scout celebration every year is Girl Scout Week. Its dates vary, but it is always the week which includes October 31, the birthday of Juliette Low, the founder of Girl Scouting in the United States. The "Seven Service Days" of Girl Scout Week are: Girl Scout Sunday (preceded by Girl Scout Sabbath); Homemaking Day (Monday); Citizenship Day (Tuesday); Health and Safety Day (Wednesday); International Friendship Day (Thursday); Arts and Crafts Day (Friday); and Out-of-Doors Day (Saturday). Girl Scouts all over the United States use these days to show their communities what they are doing in the various fields. March 12 is celebrated as Birthday Time—the day on which the first Girl Scout troop was founded. The national organization publishes two magazines, *American Girl Magazine* and *Girl Scout Leader*.

GLACIAL, gla' shal, PERIOD, or AGE OF ICE. In a period of geological history that was fairly recent as time is reckoned in the earth's story, a great sheet of ice covered continental North America as far south as the Ohio and Missouri rivers. Ice sheets, radiating from the highlands of Scandinavia and Great Britain, covered the lowlands of Northwestern Europe.

The Glacial Period, or Age of Ice, lasted thousands of centuries. It was really a

series of ice ages. During this time, the ice sheets advanced and retreated four times. They advanced during periods of colder climate and retreated during warmer intervals. The most recent glaciation is believed to have begun more than 40,000 years ago, and is still receding. About ten per cent of the area of North America that was glaciated is still buried under ice and snow, Greenland being chiefly affected. The Age of Ice is the link between the preceding era and the present Age of Man. See GEOLOGY.

The Glacial Period made very marked changes in the soil and topography of the areas covered. These changes were due to erosion and deposition.

Glacial Erosion. The debris-laden ice acted as a huge rasp, grinding off soil, weathered rock, and even huge boulders. Glacial polish of rock surfaces was produced only when the ice was carrying fine material. Gravel and sand made linear scratches, large fragments made grooves. The effect of glacial erosion in mountains was to widen and deepen the valleys, making their sides smoother and straighter. In many cases the main valley was deepened so much that the lower ends of its tributary valleys are now high above the main valley floor. The side streams descend in rapids or falls from these *hanging valleys*.

Glacial Deposition. All of the material eroded by the ice was eventually deposited either directly by the melting of ice or by streams flowing away from the ice front. Valleys were filled—in some cases with 500 feet of glacial deposits—so that rolling plains are now found in what was a rugged area before glacial time.

Moraines are deposits of assorted and unassorted clay, sand, gravel, and boulders deposited by the melting ice. Streams flowing away from the ice front built up fairly well-stratified deposits of sand, gravel, silt, or clay. Glacial lakes were formed in places where water from the melting ice was held in between the ice and higher land away from the ice. Great quantities of sediment were deposited in these lakes, resulting in the formation of lake plains. One of the

largest glacial lakes covered an area of more than 100,000 square miles in what is now the Red River Valley, and formed the fertile wheat fields of that famous region.

During the glacial period large amounts of loess were deposited by the wind, not only in glaciated, but also in unglaciated, regions. Loess is a buff or gray loam intermediate in fineness between the finest sand and clay. One of its most striking characteristics is its ability to stand in vertical faces. Loess soils are among the most fertile in the world.

GLACIER, *glá' shur*, **NATIONAL PARK**. Icy glaciers, rippling streams, towering peaks, and crystal lakes abound in Glacier National Park, located in Northwestern Montana. With an area greater than that of the state of Rhode Island, the park is noted for its impressive beauty and imposing grandeur. Each year its sixty glaciers are viewed by tourists from all parts of the United States and from other countries as well. The park was created by the Federal Government in 1910 and is open to the public from spring to fall. See Parks, National.

GLACIERS, *glá' shurz*. In any region where the summer is not sufficiently warm to melt the snowfall of the previous winter, perennial snowfields are found. The lower edge of a snowfield is called the snow line. The altitude of the snow line is determined to a large extent by summer temperature and snowfall. In equatorial regions, the snow line has an altitude of 15,000 to 18,000 feet. In the Polar regions it reaches sea level.

The accumulated snow above the snow line is gradually transformed into ice, which with increased depth begins to move. The moving ice is called a glacier.

Kinds of Glaciers. A mass of ice flowing slowly down a mountain valley is a *valley glacier*. This type is common in the Alps, the Himalayas, the Scandinavian mountains, the southern Andes, and the higher mountains of Northwestern United States, Western Canada, and Alaska.

An *ice cap* is a glacier in which there is

movement outward in all directions from a center on a plain or plateau. The Greenland glacier is an ice cap. An ice cap covering a large part of a continent is called a *continental glacier*.

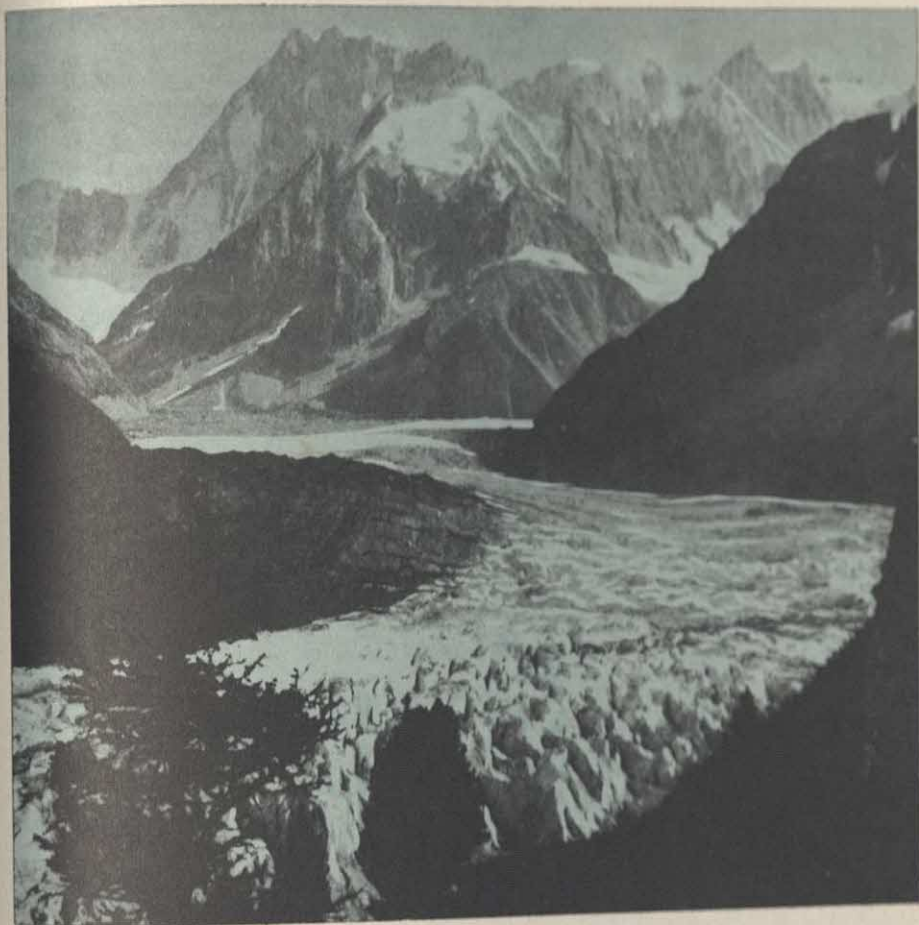
A *tidal glacier* is one whose lower end reaches to the sea, where large masses of ice break off and float away as icebergs. Icebergs from Greenland and Alaska are a serious menace to navigation.

Glacial Movements. The end or front of a glacier is spoken of as *advancing*, *retreating*, or *stationary*, depending upon whether melting is less than, exceeds, or equals the rate of movement. The fact that the ice moves has been determined by setting stakes on glaciers and determining their position from time to time with reference to fixed points away from the glaciers. This rate of movement varies greatly from a few feet a year to as much as 100 feet a day. The ice in general moves more rapidly in the center than on the sides, and more rapidly in summer than in winter.

Glaciers respond to heavy falls of snow just as rivers respond to heavy rains or rapid melting of snow. But a flood which would pass down a stream of water in a few days may require many years to reach the end of an ice stream. Like a river, a glacier moves more rapidly in narrow places or where the slope is steeper; and, like the river, the glacier carries a load of both coarse and fine rock, which it grinds off the sides and bottom of its course.

If a glacier is moving very slowly, its surface is likely to be smooth and covered by debris; if moving more rapidly, the surface is broken by large cracks called *crevasses*, and the ice appears cleaner.

The material accumulated on the side of a glacier is a *lateral moraine*. A *medial moraine* is one away from the sides; at a distance it looks like a dark highway extending up the glacier. A *terminal moraine* is the accumulation formed at the front of a stationary or nearly stationary glacier. *Ground moraine* is the material deposited under a continental glacier. As streams form from the end of the glacier they bear



A COLOSSUS OF ICE CARVES OUT ITS VALLEY

Huge ice formations like frozen rivers, glaciers form high in the mountains, inch relentlessly down toward lower levels. This is the "Sea of Ice" near Mont Blanc, in the Alps.

a load of mud, sand, gravel, and boulders, much of which is deposited to build *outwash plains* within a few miles of the front of the glacier. The great commercial gravel pits are located in deposits formed in this way by the assorting action of the water.

Aside from the scenic standpoint, glaciers are very valuable to man. Glaciers store up snow and ice in seasons of heavy precipitation. From their reservoirs, there is a relatively constant supply of water for irrigation and water power during the summer.

Glaciers We Can Visit. In these days of

automobile touring, the beauty and the wonders of glaciers need no longer be enjoyed only through books and pictures, or by a few fortunate travelers. The glaciers of Switzerland and Alaska still hold their charm for those who visit them, but Americans and Canadians do not need to go so far afield to learn of glaciers at first hand. Besides the famous glaciers along the Canadian Pacific Railway in Alberta, the sixty which lie in Glacier National Park, Mont., and the more than twenty-eight in Mount Rainier National Park, Wash., are now visited each summer by thousands.



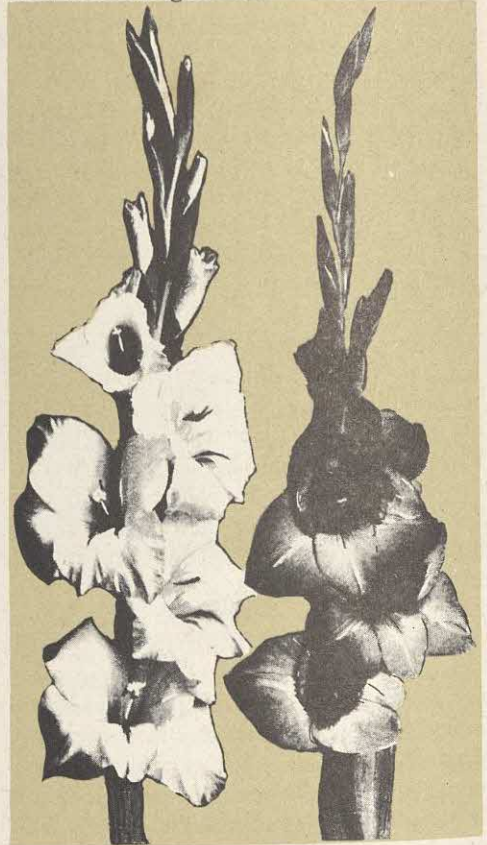
"MORITURI TE SALUTAMUS"

"We who are about to die salute you!" Thus spoke the Roman gladiators, bowing to the emperor.

GLADIATOR, *glad' i a tor*. As entertaining to the Romans as prize fighting is to the modern world were the contests waged between gladiators in huge arenas. These fighters were pitted against other gladiators or wild beasts, or joined with other men to battle another party. The gladiator was armed only with a short dagger and a shield; and if one were overpowered, the spectators decided, by turning thumbs up or down, whether the victim

should be given his freedom or be killed.

When the contests were first held, they were fought by slaves or captives. Later, Christians were thrown into the arenas, but they made poor gladiators since they refused to fight. In the latter part of the empire, freedmen who could find no other way of making money entered the lists, and regular training schools were held. Most gladiatorial contests were brutal and bloody, and in one series, said to have lasted 100 days when Trajan was emperor, 2,000 men were slaughtered.



PLANT OF MANY COLORS

Gladioli can be grown to match any garden.

GLADIOLUS, *gladi' o lus*, or *gladi' o' lus*. There are hundreds of cultivated varieties of this handsome plant of the iris family. It is considered the best of summer-flowering bulbous plants. The principal points in their culture are to plant in a good loam,

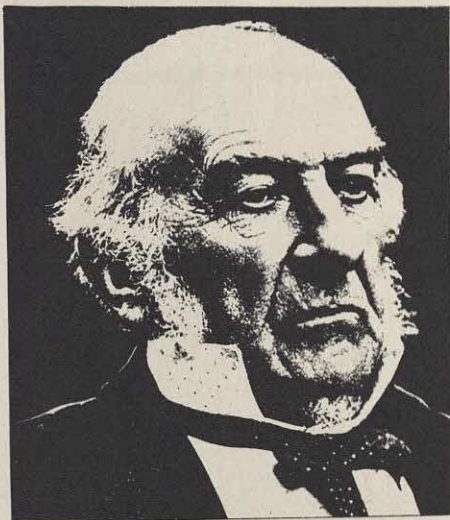
setting the bulbs six to seven inches deep so that staking will not be necessary; to use a fertilizer rich in phosphoric acid and potash; to dig the bulbs after a severe frost.

Gladioli are propagated naturally by the production each year of new bulbs, properly called *corms*, above the old ones. Small bulbs, usually the size of peas, known as *cormels*, grow at the sides of the corms. They may be planted in the spring at the same time as the large bulbs and will not differ from the variety from which they are taken.

GLADSTONE, *glad'stun*, WILLIAM EWART (1809-1898). No greater Liberal statesman ever lived in England than William Gladstone, who, during his four terms as Prime Minister under Queen Victoria, led a constant fight for Irish Home Rule. A powerful orator, he was a match for his opponent, the great Disraeli. Clinging honestly to his views, he did not depend on party politics, but many times went to the people for support.

Of Scotch ancestry, Gladstone was born at Liverpool and educated at Eton College and at Christ Church College, Oxford. At the early age of twenty-three he entered Parliament as a member of the Tory, or Conservative, party. However, finding that his political philosophy leaned more and more toward liberalism, Gladstone shifted to the Liberal party. As parliamentary representative from Oxford, he delivered a memorable speech against the budget of Disraeli in 1852. His interest in finance led to his appointment as Chancellor of the Exchequer under both the Earl of Aberdeen and Lord Palmerston, and the budgets produced between 1859 and 1865 are held by many as models. He became Liberal leader of the House of Commons in 1865, and supported the Reform Bill of 1867, which was denounced by his former party associates.

Returned to Parliament in 1868 with the Liberal party in the majority, he was appointed Prime Minister. Then followed the passage of two Irish bills, one providing for the dis-establishment of the Irish



VICTORIA'S "LOYAL OPPOSER"

William Ewart Gladstone was nineteenth-century England's great Liberal Prime Minister.

Church and the other, the Irish Land Act, providing reforms in the Irish land system. In 1874 Disraeli was returned to power along with the Conservatives, but the speeches of Gladstone during his campaign for election were effective in bringing Disraeli's administration to disfavor.

Again popular support placed Gladstone in power, and he became Prime Minister in 1880. He succeeded in having passed two Irish reform acts, bankruptcy measures, and an extension of the suffrage; but this term was short-lived.

When Gladstone again became Prime Minister, in 1886, he made a desperate attempt to have passed a Home Rule bill for Ireland, which so startled the country that he lost not only parliamentary support but the support of the people when he appealed to them. He was forced to resign in favor of Lord Salisbury. In 1892 Salisbury again made way for Gladstone, who once more tried to pass a Home Rule bill. He was successful in the House of Commons, but was defeated by the House of Lords.

Retiring from public life at the age of eighty-five, he left behind him an enviable record. It was notable not so much for concrete results as for the democratic influ-

ence which was to dominate British government in the years to come.

GLANDS. It has been shown that health depends to a great extent on glands, the bodily organs whose function is to separate certain substances from the blood. The connection between the glands and mental activity shows why calm, cheerful people are apt to be strong and hearty.

Two Kinds of Glands. There are two types of glands in human beings and other mammals. Those of the first type discharge fluids through small channels, or *ducts*, onto the surface of the skin or mucous membranes. Those of the second type discharge substances directly into the blood. The first are known as glands of *external secretion*, or "true secreting glands." The second are called glands of *internal secretion*, *endocrine glands*, or *ductless glands*.

Glands of External Secretion. A true secreting gland is an organ which elaborates from the blood certain constituents required for the maintenance of the body's functions, or separates harmful or unnecessary products, which are excreted. An example of the former is the pancreas; of the latter, the kidneys. Secreting glands consist of clusters of *follicles* (minute sacs, or tubes); these are lined with *epithelial cells*, resting on a basement membrane surrounded by capillary vessels which bring the blood into close connection with the secreting cells.

Sweat glands, intestinal glands, glands of the stomach, salivary glands, tear glands, sebaceous glands (those that oil the skin), and mammary glands are glands of external secretion. So are the kidneys and liver. Other glands, like the pancreas, are of this classification in part of their operations, but also function as ductless glands.

The Function of Ductless Glands. It seems to be characteristic of the ductless glands to secrete substances called *hormones* ("exciters"), which pass through the blood and influence the action of other organs. Thus, for example, a hormone from the pituitary gland, in the head, helps in sexual development and reproduction,

and another pituitary hormone stimulates growth of the skeleton.

The organs considered ductless glands are the thyroid, parathyroids, pituitary, thymus, testicles, ovaries, adrenals, pancreas, and spleen.

The thyroid lies at the front and sides of the larynx; when it is absent in an individual from birth, physical and mental development is impaired; when it is overdeveloped, it constitutes a goiter. The parathyroids are four small glands in contact with the thyroid; they help control the body's calcium and phosphorus. The pituitary, a gland in the brain, governs bodily growth. Its derangement frequently produces *giantism*. The function of the thymus gland in the neck is still not fully understood by science. All the ductless glands have specific functions. In general, their secretions normally energize the various organs of the body, while the overaction produces harmful results.

GLASGOW, SCOTLAND. Sprawling along both banks of the Clyde, one of the busiest commercial rivers in Great Britain, is the smoky city of Glasgow, the largest in Scotland and the third largest city in the British Isles. Located near rich coal and iron deposits, the city is noted for its thriving industries, particularly shipbuilding. The population is over 2,000,000.

Management of the City. Glasgow is outstanding for its program of city planning. In one of the most successful examples of public co-operation, all the public services are controlled by the municipal government, and there are no privately owned utilities. The transportation systems are owned by the city, as are many large markets; and all slaughtering is under the control of the city government. City employs clean yards, streets, and alleys; even the garbage is processed into commercial products which are sold at a profit. A low-cost housing system is maintained by the municipal government, as well as the public lodging houses.

Under the planning program, the modern sections of Glasgow contain beautiful



SCOTT SURVEYS GLASGOW'S CIVIC CENTER

Glasgow, proud old Scottish city, was the scene of a famous Scottish victory over the English in 1300. Today it is a thriving modern city which carries its years gracefully.

buildings that face wide, parallel streets. In the older, eastern section of the city, the streets are narrow and winding. Here stand buildings that date back hundreds of years, and some of them are of historical interest. The main business center stretches along the Clyde on both banks. There are several imposing public buildings, including the post office and the municipal building. There are many parks with landscaped grounds and beautiful monuments; the most imposing monument is the statue of Sir Walter Scott on top of an eighty-foot column in George Square.

Commerce and Industry. Glasgow early became an important manufacturing city. Lying near the mouth of the Clyde River, which is a deep waterway with an excellent harbor, Glasgow exports many products to

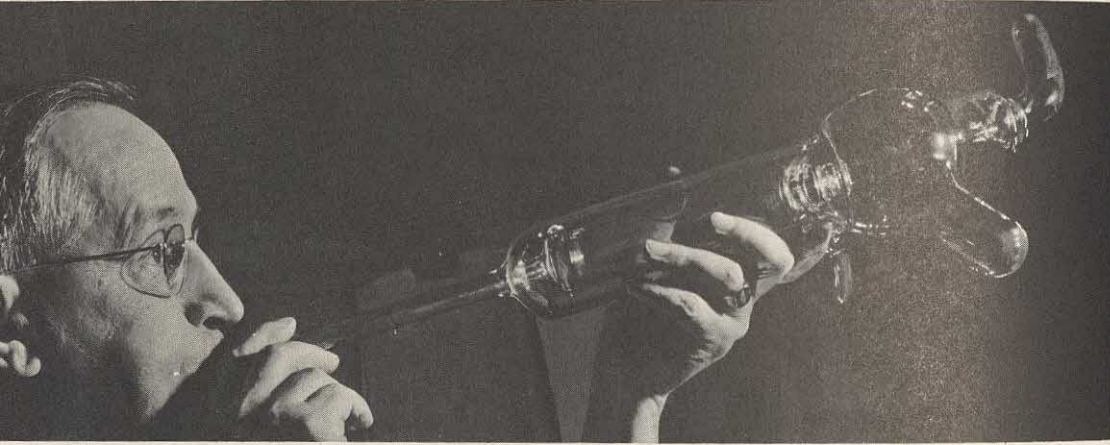
all parts of the world. Important among exports are linen, cotton, and woolen goods, and chemicals, coal, whisky, and paper. With near-by coal and iron regions from which to obtain raw materials, the steel industry has grown to be one of the most important in Great Britain, and its products, including machinery, are shipped to world markets. The city, however, is famed especially as a shipbuilding center. In the many shipyards that line the Clyde, vessels of all sizes are built, and many of the large Atlantic liners were constructed here.

Education. Glasgow has long been an important educational center. Here is the famous University of Glasgow and also Anderson College, Saint Margaret's College for Women, the United Free Church College, and Saint Mungo's College. The

city also maintains a public-school system.

History. When Saint Kentigern (Saint Mungo) built a little wooden church on the banks of the Clyde in the middle of the sixth century, he did not know that his little parish would some day become one of the world's great centers of population. However, after that small beginning the city had a slow growth for the next 500

years. The settlement grew more rapidly after the Prince of Cumbria built a larger and more permanent church in 1116. At Glasgow an army of Scots under William Wallace defeated the English in a battle in 1300. Although the city became a royal burgh in 1636, it was not until Scotland and England united in 1707 that it really began to prosper.



Westinghouse

BLOWN GLASS FOR SCIENCE

GLASS. More valuable to man than diamonds, rubies, emeralds, or other precious gems is glass, a man-made substance so ancient that its origin is unknown. It can be spun into wires or ground into mirrors. It can be made so thin that it will bend when touched, or so strong that it can support a freight car.

In the home, glass has an infinite number of uses. Windows, mirrors, table glasses and pitchers, vases, bowls, bottles, jars, kitchenware, dishes, ash trays, and ornaments are so common that we hardly realize their existence. Industry makes use of glass in insulators for electrical wiring, bricks for building, glass wool for heat insulation, glass cloth for fireproofing, bottles and jars, windshields, windows, lights, and mirrors for automobiles, lamps, bulbs, and lenses for cameras.

It is estimated that four fifths of all equipment in a scientific laboratory is made of glass. Tubes, coils, cauldrons, jars, thermometers, and lenses and mirrors for microscopes and telescopes are made of this useful substance. Glass also aids the medical sciences, for spectacles and thermometers are invaluable to mankind. Even the field of sports has felt the influence of glass, a fine type of diving springboard having been designed in glass.

How It Is Made. All glass has sand for a base, but the other materials that go into its manufacture depend upon the purpose for which the glass is to be used and the grade desired. All ingredients, however, must be pure. If the sand contains too much iron, for instance, discoloration results. There are more than eighty chemical elements that may be mixed with sand

to form glass, and the various combinations are what make the various types of glass. Lime and soda are commonly used, especially when a brittle quality is desired. Lead keeps out X-rays and adds luster, and barium gives glass a fine sparkle. Manganese, copper, potash, tin, zinc, saltpeter, silica, cobalt, and arsenic each have a certain quality which may be imparted to glass if mixed. If the glass is to be colored, oxides of metals are added to give the desired color.

To make the glass, the various ingredients are ground and mixed. They are then placed in either a pot furnace or a tank furnace. When the pot furnace is used, the ingredients are placed in huge pots made of fire clay which are built over large gas furnaces capable of producing intense heat. When the tank furnace is used, the ingredients are thrown into the tank; this type of furnace is the one most used in modern glassmaking. The mixture is melted in about a day's time, depending on the various elements. When it has become a clear liquid, it is taken out and blown.

ART AND ARTISAN

Glass has been an art medium throughout history because of its ability to capture and shape light. The finest art glass is matchless crystal, decorated by combining the sensitive talents of the artist who makes the original drawing and the artisan who cuts or engraves the piece.

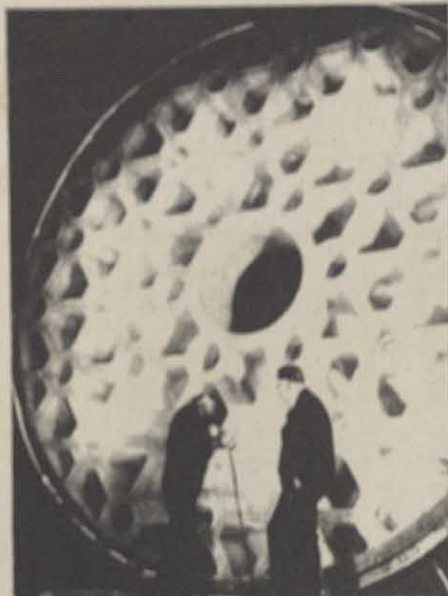
pressed, or cast, depending on the article being manufactured. For bottles, the liquid glass is drawn off and blown automatically in molds.

Ordinary windowpanes can be blown, the glass forming a huge balloon at the end of the blowpipe. When it is cooled, the ends and one side are cracked with a diamond, and the central portion is heated again in the form of a cylinder. Then it is

unrolled to become flat. Another method of making windowpanes is to stick a pole into a pool of molten glass and raise it quickly. The glass adheres to the pole and is pulled up in a flat sheet. Plate glass for large store windows and mirrors is made by pouring the glass on a large, flat table over which a heavy roller presses it into shape. Very pure materials are used in this process, and the glass is polished thor-



Corning Glass Works



Courtesy Corning Glass Works

GLASS REACHES TO THE STARS

This 200-inch glass mirror for the world's largest telescope weighs twenty tons, even with its weight-reducing, hollowed back. It took a year to cool after pouring; three years were required for grinding the surface.

oughly to give it softness and brilliance.

Vases, large jars, and ornamental glassware are blown by men who are highly skilled. They dip their blowpipes into the molten glass until a certain amount adheres to the end; then they blow on the pipe, causing a bubble to form. By whirling the pipe skillfully and manipulating the breath and pipe, glass blowers are able to fashion any type of vase or jar.

Tumblers, ash trays, and cooking utensils are cast or stamped from ribbons of glass instead of blown. The molten glass descends a chute to a stamping machine which presses the desired form into the glass, releasing it to be cooled.

Most glass is prevented from cracking readily by annealing, a process of heating and slow cooling which releases the strains which may cause cracking. To make great telescope mirrors, the annealing process takes many months. The largest mirror

ever made—sixteen feet in diameter—took almost a year to anneal. Lenses are made by rubbing pure grained glass against a curved metal plate covered with a hard abrasive.

Non-shatterable glass used in automobiles is made by quickly cooling hot sheets of glass with a blast of air. This process causes the outside layers to shrink and compress the inner layers, and the glass becomes strong enough to resist all normal pressure. If the pressure on this "case-hardened" glass becomes too strong, the glass crumbles, instead of splintering, thus reducing the danger of injury.

Glass bricks for buildings are hollow, permitting light to pass through. The reason they are not transparent, however, is that ribs on the inside scatter in all directions the light passing through them.

Experiments have been made with glass wire and fibers, resulting in a cloth that is fireproof, warm, and soft but, unfortunately, not suitable for clothing because it will not stretch. Glass wool is composed of glass fibers and is a fine insulating material for electric refrigerators, buildings, and water tanks. In addition, it will insulate a house against insects and will check fire. Glass wire, as thin as a spider's thread, is stronger than steel piano wire, but because of its brittleness it cannot be used for most purposes of ordinary wire. Some glasses, like fused silica, however, make better cooking utensils and silk reels than steel.

In addition to the plate, blown, and fibrous types of glass, there are several other types used mainly for ornamental purposes. Glass used by the ancients was colored because of impure substances contained in the ingredients. During the Middle Ages, the making of stained glass reached a high degree of art, and in the Gothic cathedrals of Europe may be seen many fine examples of delicate glasswork. Imitations of precious gems also can be made from colored glass. Figures and designs can be fused into vases and ornamental ware by heating, or by etching with acids. Cut glass is made by grinding high-

quality flint glass with emery wheels. The glass must, of course, be quite thick for this type of ware. Thin glasses for the dinner table are made by pressing the glass in molds.

History of Glass. Glassmaking was known by the Egyptians, Chinese, and other ancient peoples. Ornaments, utensils, and pictures of glass and glass manufacture have been found in tombs three and four thousand years old. The Greeks, too, were highly skilled in glassmaking and, like the people who came before them, made many ornamental articles. Practically all ancient glass is colored. Glass for windows is said to have originated in England in about the seventh century, but not until comparatively recent times was it used in buildings other than cathedrals.

The United States today is one of the leading manufacturers of glass products, exporting millions of dollars' worth every year. Germany, however, has led the world in making fine lenses and optical glass. Ever since the varied uses of glass became known, scientists have searched for the perfect glass—a substance that would bend as easily as celluloid but be as strong as steel. So far, however, the brittleness of glass has frustrated their efforts. See **BOTTLE**; **STAINED GLASS**.

GLID'ER. See **FLYING, STORY OF**.

GLOBE. Because the earth is round, it is impossible to make a true copy of it on a flat map. For this reason, the map on a globe, which is shaped like a ball, is the most accurate representation of the earth's surface that man has.

Globes are usually made of metal, plaster, or pasteboard through which is run a wire which represents the earth's axis. The ends of the wire represent the North Pole and South Pole. In addition to the land outlines on a *terrestrial globe*, which is a map of the earth's surface, there are lines of latitude and meridians, and lines representing the principal ocean currents and the leading ocean trade routes. The meridian lines, those running north and south, are usually drawn at 15-degree intervals along the



MARBLER SPIN INTO YARN

These marbles (above) are not for games. The little glass balls are melted and formed into threads in making glass fiber spinning machines (below) twist them then into yarn for weaving into cloth.



G.E.N. Photo by Palmer

equator; they are often called *hour circles*, for every two lines represent a difference of one hour in time.

There is also a *celestial globe*, used by astronomers, on which the heavens are represented.

GLOVE, glove. The American Indians used arrows wrapped in a snakeskin, the medieval king used his glove—both served the same purpose, a challenge to combat. Gloves have been known to man since very early times, and there is some evidence that

prehistoric peoples may have used them.

This sheathlike hand covering, which has individual sections for each of the fingers, was used by the Romans as an ornament; the Greeks used gloves for protection. Not until the Middle Ages did gloves begin to have special uses. Then they were offered in the courts as a challenge and by military men as a signal for combat. By 1400, gloves were generally worn in England and Europe.

The finest and most expensive women's gloves come from France; but Gloversville, N. Y., is the world center for the manufacture of men's gloves. Four million dozen pairs of leather gloves and mittens are made each year in the United States.

GLOWWORM. See FIREFLY.

GLUCK, CHRISTOPH WILIBALD VON (1714-1787). The father of modern grand opera was the German composer Gluck. It was he who started the musical revolution of the eighteenth century, in which true musical drama took the place of the old Italian "song recitals in costume."



FATHER OF GRAND OPERA

Christoph Wilibald Gluck, renowned composer.

Like a number of the great German musicians, Gluck was a native of Bavaria, in South Germany. His first opera, *Artaxerxes*, was produced in 1741, and was a decided departure from the stilted and arti-

ficial works of the old Italian school. It created a sensation in Milan, where it was first produced. The custom had been to take some plot—any plot—and set it to music. Absurdity and triviality did not matter; all that was required was an opportunity for a song. Gluck showed that music could express truly great drama; his plots were sound and the dialogue was of high quality.

Later in his life, Gluck met the great Handel, and this composer's influence is strong in Gluck's later operas. The best known of these is *Orpheus and Eurydice*, first performed in 1762 and still in the repertoire of opera companies. From a musical standpoint, perhaps the best of Gluck's works are *Iphigenia in Aulis*, and its sequel, *Iphigenia in Tauris*. *Paris and Helen* and *Antigone* also met with great success.

GLUCOSE (also called DEXTROSE and GRAPE SUGAR). The can of corn syrup on the pantry shelf is nearly half glucose, and many fruits and plants contain this type of sugar. All starches and sugars, when digested, turn into glucose, which is distributed by the blood to the tissues of the body and is there burned to supply energy.

The manufacture of commercial glucose from ordinary cornstarch has become an important industry in the United States. In the process, corn is soaked in a solution of water and sulphurous acid for from forty-eight to seventy-two hours. It is then ground into meal and soaked again, this time in a mixture of starch and water; this step releases the germ of the corn, permitting it to rise to the surface, where it is taken off and used to make corn oil. The heavy starch and other substances go to the bottom. Next pure starch is separated from the hull and other impurities by washing.

At this point the actual process of making the glucose begins. The starch is placed in tightly closed containers (converters), mixed with water and either hydrochloric or sulphuric acid, and heated by steam from ten to thirty minutes, according to the quality of glucose which is being made.

The glucose is separated from this solution by a chemical process. By boiling and filtering, corn syrup, a substance about half pure glucose, is obtained. It is considered a satisfactory commercial substitute for sugar in canning and in preparing jellies, pastries, and candies. Because of its increased popularity and low cost, millions of dollars' worth of "commercial" glucose in syrup form is exported each year from the United States. See CORN; SUGAR.

GLUE. Impure gelatin from waste parts of animal hoofs, horns, hides, and sinews is used in making the adhesive, glue. The material is cleaned and then boiled. A solution is obtained which congeals when cool. This is cut in strips and is prepared for use by dissolving in boiling water. Specially prepared glues, ready to use, are sold in airtight tubes or bottles. Some waterproof glues are made of rubber and shellac.

GLUTEN. About nine tenths of the protein of the wheat grain is gluten. This substance, which contains carbon, hydrogen, nitrogen, and sulphur, is composed of two proteins, *gliadin*, giving tenacity and elasticity, and *glutenin*, giving strength. Gluten is what makes wheat flour good for bread; it forms an elastic skin around the bubbles produced by yeast in the dough, thus insuring a light loaf. See FLOUR.

GLYCERINE, *glis'ur in*. When a farmer blasts the stumps from his new fields with dynamite, he is not likely to think of this valuable explosive as an agricultural product, a part of which may have been produced on his own farm. But in a measure it is. For the explosive part of dynamite is nitroglycerine, made from glycerine, nitrogen, and oxygen. And virtually the only source of glycerine in the world today is the fat from animals and plants.

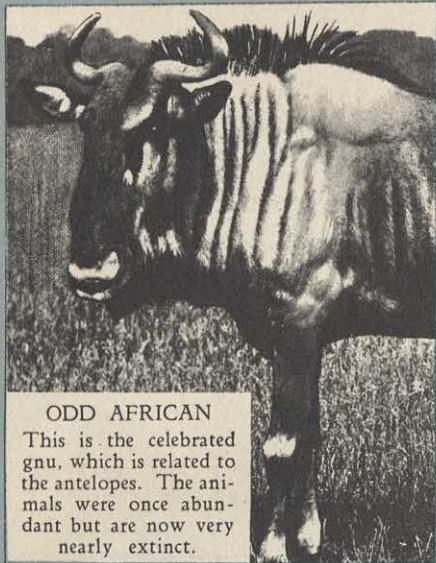
Glycerine is one of the most important substances which the science of chemistry has given to the modern world. It was discovered in 1779, but not for many years were its many properties known. Gradually, men learned that glycerine softens the skin and, therefore, is useful in cosmetics; that it is oily and yet will mix with water;

that it is extremely valuable in dissolving other substances; and that it has a sweet, rather pleasant taste. Then, in 1863, Alfred Nobel, a citizen of Sweden (famous for his Nobel Prizes), discovered nitroglycerine (see EXPLOSIVES). Now, many millions of pounds of glycerine are each year produced in the United States alone.

GNAT, *nat*. Along a country road on a summer evening, one is apt to walk into a blinding cloud of tiny insects, called gnats. The name is applied to almost any kind of small insects which fly in swarms. Even mosquitoes are sometimes so-called. Most gnats, however, do not sting human beings, but attack plants and cause "galls." Hessian flies and some other small flies are referred to as the *gall-gnat* family.

GNEISS, *nise*. Composed of the same minerals as granite, gneiss is a crystallized rock containing many metallic ores, such as gold, silver, cobalt, copper, and iron. It differs from granite in that the minerals are arranged to give a distinct banded appearance. The bands are sometimes straight and sometimes curved and twisted in fantastic patterns. Like granite, gneiss contains crystals of quartz, feldspar, and mica, but some types contain hornblende instead of mica and are classed as syenitic gneiss. Gneiss is found chiefly in the United States in New England and in the eastern and southern parts of New York. In Europe it is abundant in Norway, the Pyrenees, and the Alps. It is used for paving and building purposes.

GNU, *nu*. Imagine an antelope, a buffalo, and a horse combined to form one animal, and you will have a mental picture of the gnu, an antelope found in South Africa. Gnus live in herds and will defend themselves fiercely when attacked. Both sexes have horns, which are long and curved sharply upward at the ends; the head and shoulders resemble those of the buffalo. An average-sized gnu is about nine feet long and from four to five feet high at the shoulder. With its face covered with stiff black hair, its white mane, and horselike tail, the gnu is an odd-looking creature indeed.



ODD AFRICAN

This is the celebrated gnu, which is related to the antelopes. The animals were once abundant but are now very nearly extinct.

GOAT. There are many areas in the world where the goat is the leading domestic animal. Particularly does this apply in semi-arid regions, for goats can thrive on scanty vegetation, leaves, and shrubs, in places where cattle and sheep could not exist. Often called the "poor man's cow," the goat is a most useful animal, for not only does it furnish meat, but milk, hair, and hides.

While the goat is a member of the sheep family, it is far more active and is recognized as a proficient fighter. All goats have hollow horns which curve slightly backward. The males are bearded. Because of their agility and aggressiveness, goats are often kept in pastures with flocks of sheep as a protection against dogs, for no full-grown goat will hesitate to attack a dog, regardless of his size. Yet they make fine pets for children, who often harness and drive them as they would a pony.

In neither America nor Great Britain has the goat achieved much favor as a domestic animal, although in recent years goat's milk has become a valuable product in large cities. Far richer than cow's milk, it is often used exclusively for feeding invalids and undernourished babies. More important



THE POOR MAN'S COW

Goats have a reputation for bad manners, but they provide rich milk and valuable hides.

commercially than milk goats are those raised for their hair and hides, from which come mohair and leather, respectively.

Other Kinds of Goats. Outstanding in the goat family is the *Angora* goat, a native of Asia Minor. Its hair is white, fine, and silky, and lies in ringlets fully a foot long. It is imported into the United States to be used in making mohair, a covering for upholstered furniture.

One of America's most interesting goats is the *Rocky Mountain* goat, living in the Rockies and the Cascade Mountains of Montana and Washington and as far north as Alaska. Of awkward appearance, it has a humped goatlike form, with a coat of long, coarse, white hair, and short, black, back-curved horns. In spite of their awk-

ward appearance, these goats are most agile, and can skip along a rocky ledge only a few inches wide, where a slip would plunge them to their deaths thousands of feet below. They feed on moss and lichens and have few enemies, but are often hunted by man as trophies.



THREE OF MANY KINDS OF GOATS

- (1) The Rocky Mountain goat of North America, the incredibly sure-footed high-climber. (2) An Angora goat, whose wool provides mohair. (3) The finest of milk goats—a Toggenburg.

GOBI, go'be. In the misty ages of prehistoric time, the Gobi Desert, in the center of the high plateau region of Asia, was the home of primitive men and huge dinosaurs. These ancient men have been given the name of dune dwellers.

The Gobi Desert has been explored by Roy Chapman Andrews, who has uncovered huge dinosaur eggs, the skeletons of other prehistoric animals, and the sites of the villages of ancient men.

The Gobi, covering a large portion of Mongolia and Sinkiang, is about 1,000 miles long and about 600 miles wide. It is a vast expanse of sand, comprising an area of 300,000 square miles and lying from 3,000 to 5,000 feet above sea level. The climate in the Gobi is severe. Winters are very cold and summers are fiercely hot.

The eastern section of the desert is the home of nomadic Mongolian tribes, who roam about driving large herds of camels,

sheep, and horses which graze on the desert grass and shrubs. The camel, as in all other deserts, is the chief mode of travel in the Gobi, although in recent years motorcars have been used to cross the desert in the summer.

GOD. Belief in a Supreme Being, or God, is the heart of Judaism and Christianity. The ancient Hebrew conception of Jehovah, the one God, was an advanced religious ideal in an age when men feared and worshiped a multitude of smaller deities, but Jehovah at first was a tribal deity who cared only for the Israelites. The present conception of a God of all humanity, Creator and Father of all men, represents the evolution of the Israelitish God and the development of Christianity. Christ emphasized the universal Fatherhood of God.



A FRENCH CRUSADE CONQUERS HOLY JERUSALEM

In the eleventh century, Godfrey de Bouillon was declared ruler of the ancient city.

Religious experience is often the only argument needed by the devout believer, but others desire to reinforce their faith with logic. Among the arguments advanced for the existence of God is that all life and the world fit into a pattern which requires a Designer. Again, the presence of a moral force in man implies that there is a higher moral being, for the lesser cannot create the greater. Thus faith and reason are united in belief.

Those who deny the existence of God are called *atheists*; and those who see no proofs for belief or disbelief are known as *agnostics*.

GODFREY DE BOUILLON, *de booyon'* (about 1058-1100). Europe's first Crusade, undertaken in 1096, had for one of its leaders Godfrey de Bouillon, Duke of Lower Lorraine.

After the successful siege of Jerusalem in 1099, he was chosen to rule the city. With a small army at Ascalon, in the same year, he conquered an Egyptian force many times larger, compelling several towns to pay tribute. He then completed the organization of Jerusalem. See **CRUSADES**.

GOETHALS, *go'thalz*, GEORGE WASHINGTON (1858-1928). One of America's greatest construction engineers, General

Goethals is best remembered for his remarkable feat in constructing the Panama Canal. A native of Brooklyn, N. Y., he was graduated from West Point in 1880, and immediately joined the engineering corps of the army. During the Spanish-American War, he served as head of the engineers.

From February, 1907, Goethals was in full charge of the work on the Panama Canal. In 1909 he received promotion to the rank of colonel. He was the first governor of the Canal Zone, and in 1915 Congress by special act gave him the rank of major general. In that year he headed a committee to find out how the Adamson Railroad Law, affecting wages and hours of labor, was working. Following completion of this assignment, he spent some time with the New Jersey Highway Department, but was recalled to Washington to direct the building of a merchant marine. He retired from this position, following a disagreement with members of the staff, and was made acting quartermaster general of the army. In 1919 he retired to private life. See PANAMA CANAL; GORGAS, WILLIAM CRAWFORD.

GOETHE, gö'ta, JOHANN WOLFGANG VON (1749-1832). Germany's giant in the world of letters is Johann Wolfgang von Goethe, who ranks with Shakespeare and Dante as a genius of literature. His talents, which extended to poetry, drama, and fiction, showed a profound understanding of life and human nature, placing him among the outstanding German philosophers. His effect on German and world literature and other arts was felt throughout the nineteenth century.

Born in Frankfort-on-the-Main, of a wealthy family, Goethe was early attracted to the stage, and as a boy he was intensely interested in the French theater. His youth was spent in studying the various arts, and in 1865 he went to the University of Leipzig. Intending to be a lawyer, he resumed his studies at the University of Strasbourg after an illness, and received his license to practice law in 1771. It was as a student there that he broke away from the French



GERMANY'S GREATEST POET

Johann Wolfgang von Goethe, who was not only a writer but a great philosopher and patriot.

influence and developed a style in poetry that was purely his own. In Wetzlar, where he went to practice law, he had an unhappy love affair, and with this experience as a basis, wrote the *Sorrows of Werther*, which attained world notice in 1774. A year earlier, he had produced a drama, *Götz von Berlichingen*.

In 1775 Goethe became attached to the court of Charles Augustus, Duke of Saxe-Weimar, where he became the leader of a brilliant group of writers and artists which included Schiller and Wieland. In 1786 he visited Italy, and during his two-year sojourn wrote the dramas *Iphigenie* and *Egmont* and started *Tasso*. The first part of his masterpiece, *Faust*, was published in 1790. A year later, after he became director of the court theater at Weimar, he wrote the novel *Wilhelm Meister's Apprenticeship*, which was translated into English by Carlyle. A year was spent with the Prussian army in its campaign against the

French Revolutionists. *Hermann und Dorothea*, a poem of peasant life; *Elective Affinities*, a novel; an autobiography, and the second part of *Faust* were among other works that occupied the latter part of Goethe's life. During this period he married Christiane Vulpius.

Goethe did not confine himself to the art of writing, but made constant studies into various scientific subjects. Botany especially interested him, and he published a work explaining that all the parts of a plant were merely modified leaves. His ideas of the origin of life foreshadowed the work of Charles Darwin.



Courtesy Denver Equipment Co.

GOLD. As far back as the records of mankind go, they show that gold has always been considered one of the most precious metals. In the pages of history men have died, wars have been waged, and the worst crimes have been committed over the possession of this metallic element. From time immemorial it has been a symbol of wealth and of things coveted by human hearts. The name appears in many proverbs and it is customary to speak of a country's period of great achievements as its "Golden Age."

Gold in History. The ancient people of Egypt and Assyria used gold extensively in decoration, and even made utensils of it. Some of the earliest peoples fashioned idols

of gold, which they worshiped as gods. Search for gold, which today is valued as highly as ever, has never ceased, and the development of newly discovered lands has often been aided by the desire for it.

It was in search for gold that picturesque galleons sailed the Spanish Main, and the Spanish captains discovered the Pacific, enslaved the Inca Indians of Peru, and explored Mexico and the southwestern part of the United States. It was also in search for gold that the "forty-niners" crossed the continent to California and the gold seekers braved the cold of the Klondike and the burning deserts of Australia.

In modern times gold has been used as the basis of the monetary systems of many countries of the world. Among the leading nations using the gold standard were the United States, England, and France. In the United States there has been no gold coin in circulation since the Federal government called in all gold in 1933. England, after being on the gold standard for many years, abandoned it in 1932.

One of the results of World War I, and one of the causes of later suffering on the part of the people of Europe, was the fact that, whereas at the beginning of the war

"PAY DIRT" PAYS

Left, "panning" for gold—the oldest method; it is still profitable. Below, "cashing in" gold.



the United States held but a small fraction of the world's gold, at the end it held most of it. And at the present time the United States still has the greatest amount of gold. Yet it is said that all the gold on which the money of the world is based would not fill a room thirty feet square and thirty feet high.

Production. Almost every country in the world has some supply of gold. The Transvaal region of the Union of South Africa, with a seemingly limitless supply, contains more gold than any other country in the world. For years after the discovery

PURIFYING GOLD

For ages gold has been the most prized of metals. Today it is smelted by modern methods. Right, pouring molten pure gold. Below, a huge western smelter.



Courtesy Popular Mechanics

of gold in California in 1848, the United States led in gold production, but by the twentieth century had yielded first place to the Union of South Africa. Besides the United States and South Africa, major producers of gold include Canada, the Soviet Union, Australia, and West Africa. Mexico and Colombia also have rich mines. California, Colorado, Utah, South Dakota, Nevada, Arizona, Montana, Idaho, and Alaska are sources of American supply.

How Obtained. Gold is usually found in quartz veins or reefs and in sand and gravel (as placer deposits). It is taken from the latter, in the form of dust and nuggets, by washing, or placer mining, the process commonly used in the Western states. This is by far the cheapest method of obtaining gold. The largest known nugget, weighing

2,520 ounces, was found in Australia.

A more complicated method is required to extract gold from veins or lodes. The rock containing the gold is quarried and then crushed by machinery. It is then treated with mercury, which dissolves the gold to a liquid form. The pure gold is left after the mercury has been drawn off by a process of distillation. In another method, used principally for assaying, the gold is dissolved out of the ore and combined with metallic lead, through a chemical process. The resulting "button" is then melted in a porous cup which absorbs the lead and leaves the gold. This process is called *capellation*. A more important process involves the use of a cyanide solution (see METALS AND METALLURGY).

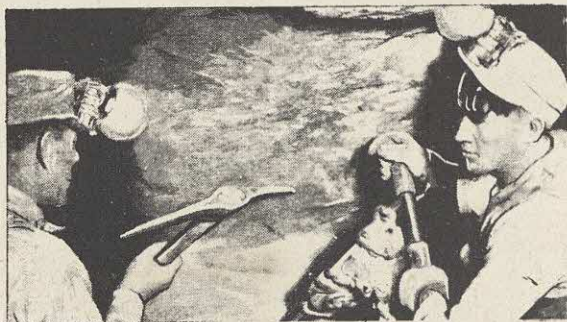
Properties. Although gold is one of the

heaviest of all known substances, it is also the most malleable metal known. A single grain weight of gold can be drawn into a thin strand more than 500 feet long, or beaten into a thin leaf with an area of fifty-six square inches. An ounce of gold on a silver wire can be drawn out to a length of more than 4,000 feet. Gold, unlike silver, will not tarnish and does not melt until heated to a very high temperature.

Because gold is so soft, it is usually used in combination with harder metals. In jewelry the percentage of gold is given by its fineness, and pure gold is said to be twenty-four carats fine. Watches, pins, and other jewelry are usually made with a mixture of three fourths pure gold and one fourth cop-

per. This mixture is called eighteen carats fine. However, jewelry that will not tarnish is made with a much higher percentage of copper. The gold that is used in British coinage is mixed with 8.33 per cent of copper and is said to be twenty-two carats fine. The gold used in United States coinage is "nine tenths fine," or 21.6 carats.

Gold Leaf. Gold that is used in decoration goes through a beating process which reduces the pure gold to very thin leaves. Some leaves are beaten so thin that it takes almost 300,000 to make a pile one inch thick. Gold leaf is used on books, signs, and for filling teeth. Many large buildings have ceilings or roofs covered with thin leaves of gold. Gold beating is an ancient art, dating back more than 4,000 years.



Above, courtesy Popular Mechanics

GOLD MINING TODAY

It's a long way from the pan mining of King Solomon's time to the modern machine mining of the twentieth century. But the lure of the yellow metal never dies. Above, hard-rock miners at work. Right, sluicing for gold. The water stream sends the ore through a series of screens.



GOLD COAST was the name of an African colony of Great Britain in north-west Africa. It stretched along the northern coast of the Gulf of Guinea for about 350 miles. White traders who found gold along the rivers of this territory in 1500 gave it its name. Gold Coast colony had an area of about 78,000 square miles. It was a rich area and produced lumber, maize, tobacco, yams, cacao beans, bananas,

palm kernels, palm oil, gold, diamonds, and manganese ore. Its capital was Accra. In 1957, the Gold Coast colony joined with the British trusteeship of Togoland to the east to become the nation of Ghana in the British Commonwealth. In 1960, Ghana became a republic. See GHANA.

GOLDEN FLEECE. See ARGONAUTS; JASON.



BREATH-TAKING BEAUTY CROWNED WITH GEOMETRIC GRACE

The Golden Gate, America's doorway to the East at San Francisco, and its famous bridge.

GOLDEN GATE, THE. San Francisco's bustling harbor opens to the Pacific Ocean through the Golden Gate, a channel of imposing beauty. It is said to have been named by Sir Francis Drake in 1578, when he sailed into the harbor to make ship repairs, but the name first appears in written records in the *Memoirs* of J. C. Fremont. A mile wide and four miles long, the Golden Gate is easily navigated by ocean liners, and it may be crossed by a great suspension bridge, completed in 1937. See SAN FRANCISCO.

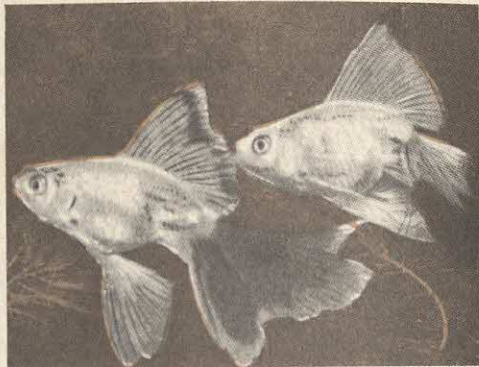
GOLD'ENROD. Tall and graceful, with its showy clusters of tiny yellow flowers, the goldenrod is one of the most common American wild flowers and is generally accepted as the national flower. It has a simple beauty which stands out in open fields where it grows in a natural state. From the roadside, its swaying blossoms can be seen from early August until almost winter. The plants may be transplanted with care, to form soft-toned and interesting sections

of flower gardens.

The goldenrod, for all its beauty, has its bad points. It may be harmful to grain crops, since some species harbor rust and other plant diseases. Inasmuch as goldenrods thrive in dry, sterile soil, fertilization and cultivation usually drive them out. When in full bloom, they should be mowed down to prevent seeding. The stalk of the Canadian goldenrod has strong fibers, which as yet have not found a commercial use. Goldenrods belong to the composite family.

GOLD'FINCH. Sometimes called a *wild canary*, the goldfinch is the small black-and-gold bird so often seen in the United States swinging on thistle heads in search of down, or picking seeds from sunflowers in the garden. It is related to the sparrows and finches. The *common*, or *American*, goldfinch, or one of its subspecies, is found from Southern Canada to Georgia and west to the Pacific coast. It moves somewhat south in winter, but is a

permanent resident over most of the United States and parts of Southern Canada. In the West a very similar bird, the *Arkansas* goldfinch, is found. The *European* goldfinch is a very different bird.



BRIGHT PARLOR SWIMMERS

Goldfish make amusing pets and gay decoration in the home; especially the more exotic varieties with long, veil-like tails and fins brilliantly colored. Left, telescopic-eye goldfish. Above, a black-tailed form.

GOLD/FISH. The ancestors of the goldfish, now so common in many American homes, originally were found in China. Members of the carp family, these fish were formerly greenish in color; but careful selection and breeding have changed their color to shining, golden tints. Dozens of curious specimens of this fish have been developed by the Chinese, who have mastered the art of raising them.

Under proper care, goldfish will live for years. From time to time, enough fresh water must be added to the aquarium to make up for evaporation, and specially prepared fish food should be given once a day. Certain aquatic plants must be grown in the aquarium to supply the fish with food and oxygen. The oxygen produced by these growing plants makes it unnecessary completely to change the water over long periods if a large enough volume of water is provided for each fish. An accepted rule is one gallon of water for each inch of fish.

GOLD'SMITH, OLIVER (1728-1774). Outstanding among the brilliant English writers of the eighteenth century was Oliver Goldsmith, author of the well-known comedy, *She Stoops to Conquer*, and the story, *The Vicar of Wakefield*.

A native of county Longford, Ireland, Goldsmith attended Trinity College, Dub-

lin, receiving his bachelor's degree in 1749. Later, he went to Edinburgh to study medicine, remained there a year and a half, and then went to Leyden. After a year in the university there, Goldsmith set out on a walking tour of France, Germany, Switzerland, and Italy, making expenses by playing the flute, telling humorous stories, and entertaining the citizens of the towns he visited.

In 1756 he arrived in London, where he



OLIVER GOLDSMITH AND FRIENDS

The Irish poet at the Mitre Tavern with great Dr. Johnson (right) and James Boswell.

took various jobs as a chemist's assistant, usher in a school, proofreader, and, finally, a writer of all sorts of articles. He wrote for several publications, and in 1764 won notice for his poem *The Traveller*. For *The Vicar of Wakefield*, which was published in 1766, Goldsmith received sixty pounds. The money was used to pay his landlady, who had caused him to be arrested for debt. Still poor, but possessed of the good humor which characterizes his works, he kept on writing, producing *The Good Natur'd Man*, a play, in 1768, and, later, *She Stoops to Conquer*, which had

immense success. In poetry, he was distinguished for *The Deserted Village*.

Goldsmith achieved wide recognition in the later years of his life, and was a member of the famed circle led by Dr. Johnson. He died as he had lived, debt-ridden, but still cheerful and optimistic. Goldsmith's work is characterized by delightful humor and a sympathetic understanding of human nature. He enjoyed portraying oddities of character, but was always kindly and tolerant. *The Deserted Village* describes in charming verse the village in which he lived when he was a boy.



IT'S "KNOW HOW" THAT COUNTS

Ben Hogan, fighting for his fourth National Open golf championship, blasts his ball from the sand in a shower of sand. He won the tournament with a record-breaking 283. Trap shots are properly played with the feet firmly planted in the sand. The clubhead is aimed about an inch behind the ball, with the sand acting as a cushion in getting the ball up and away.

Wide World

GOLF. There is no more fascinating sport in the world than that struggle against "Old Man Par," the game of golf. Universally played by men, women, and children, young or old, rich or poor, the game not only brings the player a wealth of sunshine, fresh air, and exercise, but a host of new friends with whom he must necessarily mingle in his effort to "cut a few strokes off his last score." Another fascinating feature of the game is the almost complete absence of formality, and a certain lack of self-restraint that makes the playing of golf a sort of festive and gala get-together. Yet there are few sports that require a greater amount of skill and science than does golf. Par, that goal of all golfers, is the number of strokes that a skillful player would re-

quire on each hole, and is based on distance.

Believed to have been originated in a crude form by the Dutch, golf in its present form comes to us from Scotland, where it was played as early as the fifteenth century. The world's oldest course, Saint Andrews (1774), is still played in Scotland.

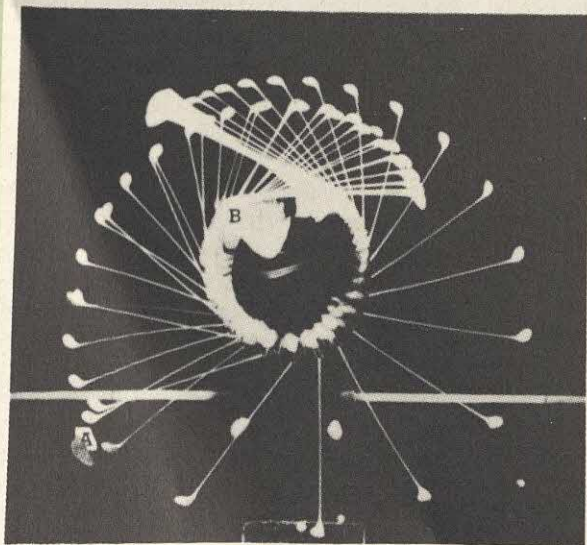
How a Golf Course Is Built. Probably the most expensive factor about golf is the necessity of providing large tracts of land for building a course. A "short" course requires at least seventy-five acres; a "long" course must have fully 150 acres. The short courses have nine *holes*, the long ones eighteen. These holes are spaced at distances ranging from 100 to over 600 yards



PROFESSIONALS PLAY GOLF

Above and at right, successive steps in driving are shown: the overlapping grip, the correct stance in addressing the ball, the backswing, and the follow-through. Below, the camera records the movement of the club as the golfer makes his drive.

*Golf Recorder Co:
A. G. Spaulding & Bros., Inc.*



apart, and the direction between holes is immaterial, so long as the grassy spaces between, called *fairways*, do not cross.

Each cup is located in a smoothly mown, grassy area, thousands of square feet in size. This area, the *green*, is so carefully tended that its surface reminds one of a luxurious Oriental rug. The metal-lined cup located on each green is about four and one-half inches in diameter and at least four inches deep. It is equipped with a flag mounted on a staff, as a guide to approaching golfers.

Between the raised mound, or *tee*, where the ball is driven off and the green toward which the ball is driven are wide grassy fairways, usually partially blocked by *hazards*. Such hazards are placed there as "troubles" for the golfer, and upon his skill depends his ability to miss them. They may consist of ditches or ponds filled with water or narrow mounds of earth called *bunkers*, guarded on the approaching side by pits of sand known as *traps*. Occasionally, hazards may be groups of trees over which the golfer must shoot to approach the green. If he chooses to go around these trees, the fairway is known as a *dogleg* because of its two-directional nature.

Equipment for the Game. Material needed for playing golf varies, but must consist of several clubs, each designed for a special purpose, a bag in which to carry them, and a few balls. The three most common wood clubs are the *driver*, used for driving the ball off the tee; the *brassie*, with a slightly pitched face, used in the fairway for long shots; and the *spoon*, with a considerable loft to its face, used for fairway shots of less than 200 yards. The clubs with iron heads, called *irons*, are numbered between 1 and 10, according to their pitch. No. 1, the *driving iron*, gives little rise to the ball and is used for long fairway shots. On the other hand, No. 9, the *niblick*, drives the ball high in the air and is used for hitting out of a rough or sand trap.

Between these are the other irons, each of which is pitched slightly more than the preceding one. The most important of

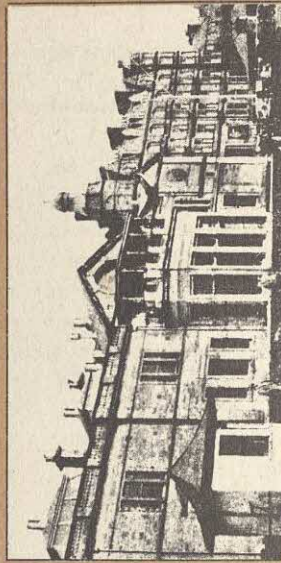
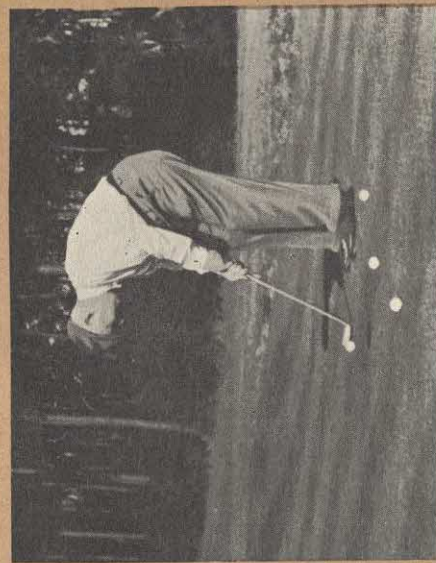
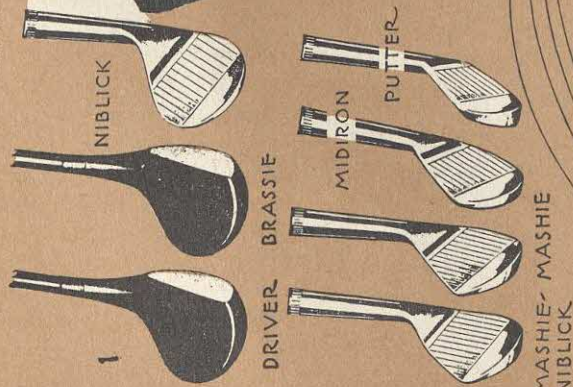
these are the *midiron*, *mashie*, and *mashie niblick*. The *putter*, No. 10, is used only on the green for hitting the ball into the cup. Club faces are usually roughened slightly to enable them to "grip" the ball more squarely.

The golf ball consists of a rubber (sometimes liquid) center, tightly wound with fine rubber bands and encased in a gutta-percha cover. It is 1.68 inches in diameter and is painted white for visibility. The bag is made of canvas, leather, or nylon and is equipped with a carrying handle and strap, as well as with pockets for holding balls, tees, and other accessories.

Though expert players and professionals often use fifteen clubs, the beginner can get along with four or five. Very large sums can be spent on golfing equipment, but a beginner's outfit can be obtained without great expense.

How Golf Is Played. The game may be played by two, three, or four people, and is called a twosome, threesome, or foursome accordingly. To begin the contest, each of the players "tees up" his own ball on a little peg of wood or plastic, specially designed to hold it in position. Then, using his driver or brassie, he drives the ball as far and straight as possible toward the first green. The others then "tee off" and they continue on down the fairway, using the club best suited to each individual shot. After they arrive on the green, they all "hole out" with their putters. The winner of the hole is the one who succeeds in getting his ball into the cup in the fewest strokes. Continuing to the second tee, the process is continued, the winner of the first hole having the "honor" and driving first on the second. And so it continues throughout the entire nine or eighteen holes, the winning player being the one who is able to finish the course with the fewest strokes.

Par for the course is set according to the total distance between holes. Holes up to 250 yards are "three par," from 250 to 450 yards "four par," and over 450 yards usually "five par." Par may be larger, however, if a certain hole is particularly difficult. If a



BEATING "OLD MAN PAR": A KNOWLEDGE OF THE PROPER CLUBS AND THE BEST GRIPS CUTS DOWN THE SCORE

These clubs are used by the average player (1). Correct stroking is imperative for improving one's game—how a top-flight golfer grips his club for a wood shot (2, 3). A green like this calls for an accurate approach shot (4); the flight distance of a ball hit with irons of different pitch (5); the home of the world's best-known golf club, Saint Andrews, Scotland (6).

(5) Country A. G. Spalding & Bros.

player shoots a hole in one under par, it is called a *birdie*; if in two under par, an *eagle*. The average eighteen-hole course will usually be about "seventy-two par."

Medal play is the system usually used in golf, and the player making the fewest strokes is the winner. In *match play*, sometimes used in tournaments, the score is kept by holes won instead of by strokes.

The Importance of Golf. Every large city and many smaller ones have golf courses in and around them. For example, in the vicinity of Chicago there are over 100 fine golf courses, several of which are public courses located in the parks of the city. They may be played by paying a small fee. Others are expensive private clubs, for the use of members and guests alone. Since there are thousands of courses scattered all over the United States and Canada, golf might well be listed as an important summer industry, each course requiring the care of from three to twelve men. Moreover, many golf experts, called *professionals*, make their living by teaching the game to beginners. The *caddies*, boys who carry the golf bags for the players, also depend upon this sport for a living.

Among the interesting events for golfers are the many tournaments that take place every year all over the country between professionals or between skilled amateurs. The ability of these men is amazing, for they can tour a golf course in an almost unbelievably low number of strokes. The most popular of the tournaments are the National Amateur, the Professional Golfers' Tournament, and—most famous of all—the National Open Tournament, where the cream of both "pros" and amateurs clash in an annual contest of skill.

Great Britain also has large amateur and open tournaments, and golfers from both nations participate in the tournaments of the two countries. In addition, each year sees international matches between selected teams of American and British golfers, the Walker Cup matches for amateurs, and the Ryder Cup clashes for professionals. These tournaments between America and Britain

have long been followed keenly by golfers of both nations, and have had no small part in maintaining the good feeling that exists between the two countries.

GOLI'ATH. When the Philistines attacked the Israelites, their tallest, strongest soldier was a giant named Goliath. According to the Bible, he stood "six cubits and a span," or slightly over eleven feet. Other accounts of the famous struggle between him and David say that he stood about eight feet. See BIBLE STORIES.

GOMPERS, SAMUEL (1850-1924). American workingmen owe much to the untiring efforts of Samuel Gompers, who helped found the American Federation of Labor, and, until his death, led labor's struggle for recognition. With the exception of one year (1894), he served as president of the Federation from its beginning in 1881 until 1924.

Coming from England at the age of thirteen, he adopted the trade of cigar making and later became the first member of the Cigar-Makers' International Union. From that time on, he fought hard for the principle of craft unionism.

During the First World War, Gompers believed that peace could be assured only by complete victory, and ardently opposed European labor movements that hoped to force peace by an international alliance of workingmen. In 1919 he took part in an inter-allied labor conference which was held at the time of the Paris Peace Conference. Among his books on the subject of labor are *Labor in Europe and America* and *Out of Their Own Mouths*. *Seventy Years of Life and Labor*, an autobiography, is his most important work. See LABOR ORGANIZATIONS.

GONDOLA. Picturesque Venice, with its canals and beautiful buildings, is the home of the romantic gondola, a flat-bottomed boat which has both bow and stern high and pointed. These boats, usually about thirty feet long and four feet wide, have a canopy in the center, where passengers sit. In the rear the gondolier propels the boat with a long pole or oar. Usually,



Ewing Galloway

IN THE CITY OF THE DOGES

Bearers of commerce and romance, Venetian gondolas glide midst the shadows of a stately past.

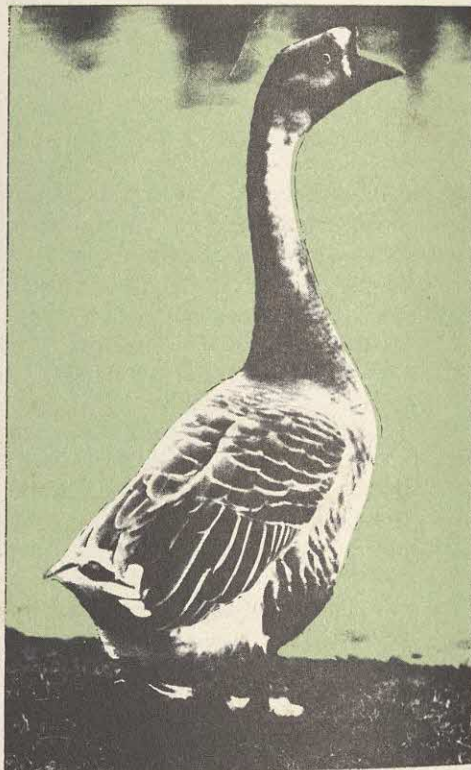
the gondolier sings as he pushes the craft down the canal. All gondolas are the same color—black—in accordance with an old law which forbids competition among gondoliers in the painting and colorful ornamentation of their craft. See **VENICE**.

GOOD FRIDAY. The Crucifixion of Jesus Christ occurred on a Friday, and that day is remembered in all Christian churches as Good Friday. The holy day falls two days before Easter, and it has been celebrated from very early times. For all Roman Catholics it is a day of fasting and prayer, when the Mass of the Presanctified is celebrated. Many Protestant churches hold services on Good Friday, and the day is observed with special reverence.

GOOD YEAR, CHARLES (1800-1860). Rubber as it is manufactured today is the result of the process invented by Charles Goodyear. Born in New Haven, Conn., Goodyear received only a scanty formal education. He began his business career in Philadelphia as a manufacturer of hardware.

At that time rubber was not what it is today. In cold weather it grew brittle and stiff, and in hot weather it became sticky and soft. For years, in poverty, Goodyear worked to find a process by which rubber

could be made more satisfactory. At last he found the solution to the problem by mixing sulphur with rubber and heating it to the melting point. This process we now know as vulcanizing. As a result of it, rubber is today one of our most useful manufactured products because it is no longer affected by temperature to any considerable extent. See **RUBBER AND RUBBER MANUFACTURE**.



BARNYARD HONKER

The old saw "silly as a goose" slanders this gander, who is really clever and courageous.

GOOSE. This big, honking cousin of the duck and swan has the bill and large feet of waterfowl and is at home in the water, but prefers to spend most of his time on land, feeding on grains and green shoots of the pasture.

There are about thirty species of wild goose, but the common wild bird of North America is the *Canada* goose (see **CANADA GOOSE**). It is highly esteemed as a game

bird and for that reason has become wise in the ways of hunters. Other types of wild geese are the *blue*, *snow*, *brant*, and *American white-fronted*.

Probably the most widely raised breed of the barnyard variety of geese is the *Toulouse*, commonly called the *gray goose*. This bird is the largest domesticated goose. The adult male, called the *gander*, weighs about twenty-six pounds, the young gander twenty pounds, the adult goose (female) twenty pounds, and the young goose sixteen pounds.

GOOSE'BERRY. A popular fruit for preserves, jams, and pies, the gooseberry is easily cultivated and very common in North America and in the northern sections of Europe and Asia. Because of its acid taste, it is not so commonly eaten raw. The gooseberry bush grows low; and the branches, covered with sharp spines, have three- to five-lobed leaves. Its flowers are small and bell-shaped. The berry may be white, yellow, red, green, or bluish black. Smooth or fuzzy, it has a prickly tuft at the end.

GOPHER, *go'fur*. Various names are given to this burrowing rodent. The true pocket gophers are easily distinguished by their short, stout bodies, the large cheek pouches opening outside the mouth, the powerful front legs especially adapted for digging, and the short, sparsely haired tails.

The prevailing colors of the various species are shades of brown or gray. They are burrowing animals, usually solitary in habit except during the breeding season, and are of a stupid, pugnacious temperament. Practically the entire life is spent underground. They only occasionally emerge as they push out a load of dirt excavated in making the burrows, which they heap in irregular piles on the surface; or they may make short forays for food. The burrows made in feeding are usually shallow and meandering, but the food-storage chambers, nests, and living quarters descend to levels two feet or more in depth.

GO'RAMY, or GOURAMI, *goo' ra mih*. Considered a table delicacy by the people



UNDERGROUND HOMEMAKER

Pocket gophers spend a large part of their lives in burrows, storing their food in "rooms."

of China and the East Indies, the *goramy* is a fish that ranges in length from two to five feet. So much is it valued as a food that it is raised in great numbers in tanks, so that there will always be a supply. The *goramy* is a striped fish, colored greenish brown. By weaving together the leaves and stems of aquatic plants, it builds a nest in which it lays eggs.

GORDIAN KNOT. "Cutting the Gordian knot" is an expression which means that a great difficulty has been overcome. The origin of the phrase lies deep in antiquity, for legend has it that a certain Phrygian peasant, Gordius, had a yoke which was hitched to a cart by an incredibly complicated knot. No one had ever been able to untie this knot, and prophets predicted that whoever did untie it would rule the earth. Alexander the Great went to Phrygia and simply cut the Gordian knot with his sword. As he did so, he declared that he would make the prophecy come true, as, indeed, he did.

GORDON, CHARLES WILLIAM (1860-1937). Under the name of Ralph Connor, Charles Gordon wrote novels of life in the Canadian Northwest which are unsurpassed in their reflection of local color and adventure. Gordon knew the land intimately, for he was born and reared in Canada where, as a minister, he had traveled in

the Northwest for a period of three years.

Of Scotch descent, he was born in the county of Glengarry, Ontario. He attended the University of Toronto and Knox College in Toronto. Following the profession of his father, Gordon was ordained by the Presbyterian Church in 1890.

After preaching in mining and lumber camps, he became pastor of a Presbyterian church at Winnipeg. Social and religious problems had most of Gordon's attention, except for the time when he served as chaplain with the Canadian forces in France during the First World War.

His novels are pictures of life as he saw it, and they also have a religious touch. The most popular include *Black Rock*, *The Sky Pilot*, *The Man from Glengarry*, and *The Prospector*.

GORGAS, WILLIAM CRAWFORD (1854-1920). Noted as one of the pioneers in the field of medicine, William C. Gorgas, an American doctor, made great contributions to the welfare of mankind when he conquered the dreaded diseases of malaria and yellow fever. He spent much of his career working in tropical regions, where these diseases abound, fighting to make the lands healthful places where people could live without danger.

Gorgas was born in Mobile, Ala. He received his college training at the University of the South (Sewanee, Tenn.), and took his medical degree from Bellevue Hospital Medical College in New York City. He became interested in the study of sanitation, and his work in this field led to his appointment as chief sanitary officer in Havana, Cuba, in 1898. Previous to that time he had been a surgeon in the United States Army.

The Panama Canal Zone became a pleasant place to live after Gorgas, appointed as its chief sanitary officer in 1904, had freed it of malaria and yellow fever. In 1914 he was appointed surgeon general of the United States Army. Congress honored him by making him a major general in 1916. He was retired in 1918. After his retirement he became a director of yellow-fever work under the International Health

Board of the Rockefeller Foundation. See GOETHALS, GEORGE WASHINGTON; PANAMA CANAL.

GOR'GONS. Medusa, a fearsome woman of Greek mythology who had bronze claws, large teeth, and hair composed of serpents, was one of three gorgons. She was the only one who was mortal, however, and was slain by Perseus, the legends say. According to tradition, a glance from a gorgon turned a human being to stone. See MEDUSA.

GORIL/LA. As tall as a man, the gorilla is a powerful animal and a ferocious one when angered. One of the anthropoid (manlike) apes, it is a native of the African jungles. It has long arms and short legs and usually walks on all fours, although it can also walk erect.

Although they are not tree-dwelling animals, gorillas often sleep in hammock-like nests in trees. The males build these hammocks by tying branches together by tough stems of plants; they then line the structures with grass. Usually, only the females and the young gorillas sleep in the nests; the males stay on the ground, probably because they are too heavy for the branches.

The foods usually eaten by gorillas are nuts, eggs, honey, fruits of palm trees, and the like. They will eat meat if they find it, although they do not kill other animals for the sake of eating them. See APE.



International

SPOKESMAN OF RUSSIA'S MASSES

Maxim Gorky's writings bitterly condemned the cruelty of old Russia; gained him much honor.



Chicago Park District; Acme Photo

GORILLAS GROW UP!

A comfortable armful in babyhood (above), gorillas grow into huge and powerful adults. At right is mighty Bushman, a favorite of Chicago zoo fans. Bushman died at twenty.



GORKY, *gor'ke*, MAXIM (real name ALEXEI MAXIMOVITCH PESHKOV) (1868-1936). A famous Russian writer, Maxim Gorky was the author of stories and plays descriptive of the sufferings of his people under the czars. Among the tragic stories are *The Outcasts*, *Three Men*, *Comrades*, and *The Magnet*. His dramas include *The Children of the Sun*, *The Barbarians*, and *The Lower Depths*.

Determined to help end the sufferings and privations of the Russian people, Gorky joined the radical party (Social

Democrats) and was exiled for a number of years for his part in the unsuccessful revolution of 1905. While in exile, he corresponded with Lenin and joined him in Moscow in 1917. After the revolution he was a leader in Soviet educational and cultural activities. He has become a national hero in Soviet Russia, and the name of his birthplace was changed from Nizhni Novgorod to Gorky.

GOS'PELS. The story of Christ's life and accounts of His teachings are contained in the books of *Matthew*, *Mark*, *Luke*, and



BARBARIC GOTHS WIN A VICTORY AND A NEW KING

Thorismund, son of Theodoric, was crowned king of the Goths after their victory at Châlons, a battle which saved Europe from the Huns.

John, the first four books of the New Testament. Known as the gospels, they are believed to have been written between sixty-five and ninety years after Christ's birth.

In the first three books, the events of Jesus' life and His teachings are treated in much the same way; these books give a synopsis of the Galilean ministry and are known as the synoptic gospels. The *Gospel of John* describes Christ's experiences in Judea.

Originally, the word *gospel* meant *good tidings*, but later it came to mean *God's story*. See JESUS CHRIST; BIBLE.

GOTHIC ARCHITECTURE. See ARCHITECTURE.

GOTHS. Nomad warriors, seeking fertile lands and plundering the rich cities of the Romans, swept over Europe from the fourth to the sixth century. Outstanding among these tribes were the Goths, a Teutonic people who by intermingling with other peoples lost their identity.

According to tradition, the Goths originated in Scandinavia. Migrating southward, they were occupying territory on the shore of the Black Sea early in the third century. In the next century they split into two groups, the Ostrogoths (Eastern Goths) and the Visigoths (Western Goths). The Ostrogoths lived along the Black Sea, and the Visigoths along the Danube.

In the year 378 the Visigoths defeated the

Romans near Adrianople, and were granted special privileges by the Roman emperor, Theodosius. An expedition into Greece, led by Alaric, king of the Visigoths, in 396, proved successful, and many Goths settled in the vicinity. In the year 410 Alaric plundered Rome; after his death, the Goths spread westward into Gaul and Spain, which they ruled as a kingdom until 711. In that year, Roderick, their king, was killed by the invading Moors.

In the meantime, the Ostrogoths, who had made few forays, grew restless. Theodoric, who became king of the tribe in 476, invaded Italy in 488, founded a kingdom, and ruled it as a powerful monarch. The kingdom, however, was broken up in 554.

GOULD, JAY (1836-1892). One of the most predatory "captains of industry" the United States has ever known, Jay Gould is remembered for the tremendous fortune he built up largely by graft and bribery. By the manipulation of railroad stocks, he amassed a fortune of more than \$70,000,000.

He was born at Roxbury, N. Y., and, while still a young man, became a surveyor. At the age of twenty he went into the lumber and tanning business and managed to make enough money to speculate in railroad stocks. With the profits from this enterprise, he set up as a broker in New York City in 1859. He made money by depressing the price of stocks and then buying them in large quantities. When the Erie Railroad proved to be a financial failure, Gould obtained control of the stock. He also gained control of the Union Pacific and Missouri Pacific railroads. At one time he controlled almost ten per cent of the railroads of the country.

By buying the controlling interest in many small telegraph companies, Gould was able to merge them into one large concern, the Western Union. In 1869, with his partner, James Fisk, he attempted to "corner" the gold of the country. His plan was to hold it until he could force people to pay his price. The plan failed, but it brought on a terrible panic, known as "Black Friday."



GENIUS OF FRENCH OPERA

Charles Gounod's music drama *Faust* is still among the most popular operas known.

GOUNOD, goo no', CHARLES FRANÇOIS (1818-1893). Few operas have achieved the universal popularity of *Faust*, the work of the French composer Charles Gounod. Like most of Gounod's works, the opera is full of tuneful melodies; and in spite of its tragic nature, it gives no feeling of depression.

Born in Paris, Gounod received a thorough musical training at the Paris Conservatory and at Italian schools. *Faust* was first performed in 1859 and was an immediate success. Even Gounod found himself unable to equal his first effort, and later operas are not up to its standard, with the possible exception of the popular *Romeo and Juliet*.

Gounod is noted also for religious compositions, the best known being *Saint Cecilia's Mass* and the oratorios *The Redemption* and *Death and Life*. Gounod was a master of the technique of composition, and his works rank among the musical classics.

GOURD, gord, or goord. Belonging to the same family as pumpkins, squashes, and melons are those interesting plants, the gourds. The growing vines are suitable for covering up fences, trellises, and various unsightly objects, and the hard-shelled fruits are both useful and ornamental when

dried With the pulp scooped out, they are sometimes used for dishes and drinking cups. Brightly colored and tied in bunches, gourds provide a cheerful decoration.

An interesting species of gourd is the

luffa, also called *dishcloth gourd* and *vegetable sponge*. When it is young the fruit is edible baked or boiled, and the fibrous center of the dried fruit can be used as a dishcloth or a bath sponge.

"—OF THE PEOPLE; BY THE PEOPLE; FOR THE PEOPLE"



United Nations

GOVERNMENT. According to the Federal Constitution, the government of the United States is vested in representatives of the people. This statement implies that the people of the United States govern themselves, for a government is the control or rule of an organization, particularly of a political state. In a democracy, those at the head of the government are responsible to the people. In a pure aristocracy, the head is independent of the people, and his will is supreme.

Whatever method of government is in operation, it embodies the principle that people need a restraining influence, sufficiently strong and respected to protect individuals in their relations with one another, and capable also of protecting the whole society from outside interference. No form of government has ever long survived if it has failed to do these things. The task of government is to define the limits of

personal liberty and to set the bounds within which individuals may enjoy liberty without infringing on the rights of others. The old principle of "might makes right" has given way to the idea of "equality before the law."

There is no general agreement as to how government originated. One theory is that it was a natural outgrowth among primitive people who found that a co-operative form of society was better for all than one in which the individual lived for himself alone. According to another theory, government was the result of a contract between a strong ruler and the people.

The theory of the "divine right of kings" held sway until well into the modern period. This theory is the belief that a king derives his power to rule from God, and is responsible to God and not to his subjects. Today the right of revolution is generally recognized, and no government that does

*Acme Photo***THEN AND NOW**

The history of American democracy is an account of endless debate, in which the pros and cons of every governmental question are aired before the people whose government it is. Above, Patrick Henry addressing the Virginia assembly in the era of the Revolution. Right, a modern political convention, made public by means of radio and television coverage.



not to some degree satisfy the majority of the people can expect to endure.

When, in 1776, the Declaration of Independence proclaimed that governments derive their powers "from the consent of the governed," a new idea was born which has since spread throughout most of the world. However, self-government implies that the people are capable of making correct decisions. When they have failed to do so, or their government has not carried out their wishes, some peoples have turned to dependence upon a dictator or a group of strong men. Even so, the idea of self-government has a strong appeal for most peoples.

With the increasing complexities of modern times, the duties of many governments have been extended to include more than a defense against outside forces and a means of arbitrating domestic differences. Governments maintain bureaus of research and release valuable information and help to individuals, organizations, and industry. They operate businesses and special services such as post offices, canals, and roads. They provide food for the hungry, work for the unemployed, and protection against old age. They encourage or supervise education. They are now instruments both of public welfare and of protection.



PROUD FRANCE IN THE GRIP OF A HEADSTRONG DESPOT

Chief drawback of old-time monarchies was that the king might prove a tyrant. Such was the case when Louis XIV, the *Roi Soleil*, said: "I am the state."

The leading forms of government that have existed in historic times are described below:

Pure Democracy. Town meetings are forms of pure democracy. Under such a government, everyone has a direct voice in making laws and choosing officers. The old New England town meeting is a very good example of this form.

Democracies and Republics. When the people really have final authority and control in their government, they have attained, as far as possible, a democratic state. Modern republics are democratic states, but do not function in the same manner as a pure democracy, in which individuals take a direct part in the government. In the typical republic, chosen representatives act for the people, who elect their legislators and many executive officers. Such methods are necessary in countries that are too large to be governed as were the New England towns.

The United States, France, and Switzerland are democracies in the form of republics. In each country the chief executive bears the title of President. Great Britain

is in reality a democracy, but has a hereditary monarch instead of an elected president. The British king, however, does not exert any real authority in the government.

Monarchy. There are two kinds of monarchies, absolute and limited. Under the absolute form, the will of the ruler is the supreme law of the land, and he recognizes no higher authority. Louis XIV of France is one of the most famous absolute monarchs in history. For centuries the Russian czars and Turkish sultans were of this class.

Constitutional, or limited, monarchies have a hereditary ruler whose powers are either granted or curbed by a popularly elected legislature. Germany before World War I was in most ways a limited monarchy, although the emperor had exceptional powers. Great Britain and the Scandinavian countries are examples of very limited monarchies.

Aristocracy. Among the ancient Greeks, this term meant a rule by the most capable. However, today it implies a government by a privileged class, such as the nobles. This form sometimes arises when the nobles become powerful enough to overthrow the

rulers, as frequently occurred during feudal days.

Oligarchy. When a few, whether nobles or commoners, overthrow the existing form of government to correct what they believe to be abuses of government, an oligarchy is formed. Oliver Cromwell's government in England was of this type. Under oligarchies might be included *dictatorships*. Under a dictatorship, an individual seizes

or is granted the authority to rule with unlimited power when the existing form of government fails to satisfy the needs of the country. Hitler in Germany, Mussolini in Italy, and Stalin in the Soviet Union were prominent dictators of the twentieth century.

For further information, consult the titles listed under CIVIL GOVERNMENT. Refer, also, to the various countries, for forms of national government existing today.



WHEN BRITAIN'S TIME-HONORED MONARCHY WAS IN ECLIPSE

For several years during the seventeenth century, Oliver Cromwell, a commoner, governed England as an oligarchy. Later the monarchy was restored.

GOVERNMENT OWNERSHIP. In most cities of the United States today, the water-distribution system is owned and controlled by the city; that is, by the people collectively through their local government. This is one example of the steadily growing tendency toward public ownership of those businesses or utilities which directly affect the general welfare. But the idea is not new. Many ancient states maintained special public services, such as the great aqueducts and sewers of Rome.

The principle involved in government ownership is that the people pay no more for the service than the cost of production; privately owned companies, on the other hand, must charge rates sufficient to bring a profit over and above the cost of produc-

tion. As yet, however, there is no general agreement as to the desirability of government ownership, many people believing that the disadvantages of such a system outweigh the advantages.

In cities where government ownership of electric and gas utilities has been tried, rates have been cut by as much as sixty per cent. Opponents of the system, however, point out that the low rates ignore the initial investment which came from taxes and which should be replaced. They cite the Tennessee Valley power project (T.V.A.), costing millions of dollars of government money; and they argue that, in spite of low rates, the public will, in the long run, pay as much for the service as they would under private ownership.



Photo by G. Schneider

THE GOVERNMENT RUNS THE RAILROADS

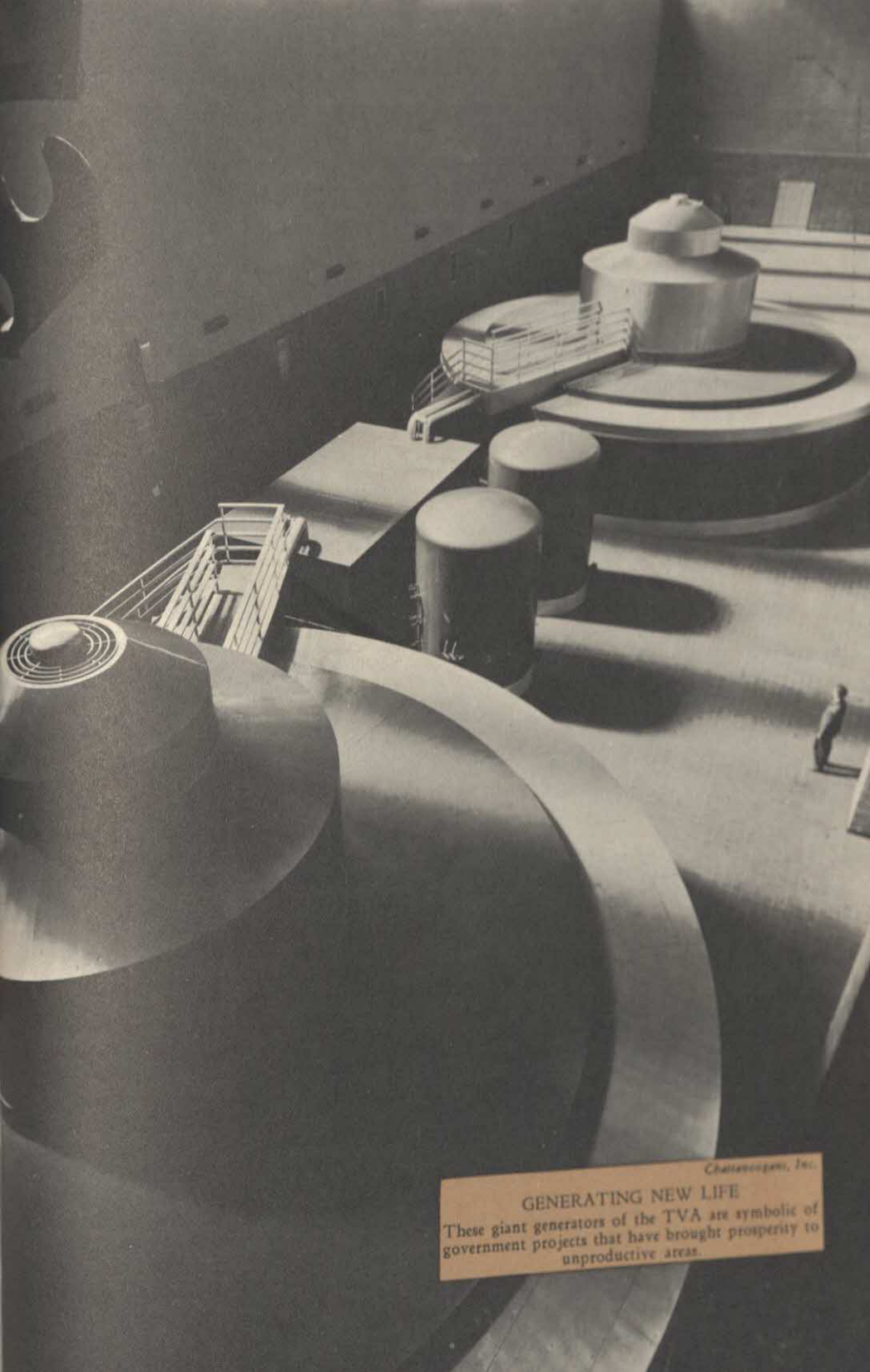
In many countries the railroad systems are owned and operated by the government. Here, a government-owned Swiss train flashes across a viaduct in an Alpine setting of striking beauty.

Then there arises the question of efficiency. Advocates of private ownership claim that competition among individual companies encourages initiative and constant improvement. However, in the case of local utilities, this argument is not always valid because most local utilities are monopolies anyway, whether under private or public ownership. In many cases, this condition alone has caused municipal governments to take over utilities, with the excep-

tion of telephones and telegraphs, which are nation-wide in character.

Opponents of government ownership also argue that the possible corruption of officeholders makes publicly owned utilities the prey of wily politicians. The people who favor government ownership, however, recall the past records of some private utilities in trying to control politics and gain special privileges.

The arguments given here for and



Chattanooga, Inc.

GENERATING NEW LIFE

These giant generators of the TVA are symbolic of government projects that have brought prosperity to unproductive areas.

against government ownership are only a few that have arisen in connection with the subject. The fact remains that in most countries today there are some examples of government ownership. For instance, the United States government operates the postal service, which was at one time in private hands. The Canadian National Railways, the British Broadcasting Corporation, the Panama Canal, and Boulder Dam are other examples of government ownership. Nevertheless, government-owned utilities for the most part are yet in the experimental stage. How well government services compare with those of private ownership can be determined fairly only by long-run observation of present experiments; and the continued trend toward government ownership depends upon the results of those experiments.

For additional information, consult the following articles:

Boulder Dam

Post Office Department

Monopoly

Public Utilities

Tennessee Valley Authority

GOVERNOR. An official chosen to administer the government of a political division or external territory of a nation is a governor, whether named by the authorities of the nation or elected by the people of the division or territory. The heads of the forty-eight state governments in the United States are governors, elected by popular vote.

GOVERNORS ISLAND. Consisting largely of reclaimed land, Governor's Island is situated in New York Harbor, just south of the tip of Manhattan Island. Used chiefly as a naval and military center, it is owned by the Federal government. Fort Jay, Castle William, and South Battery guard the island.

GRACCHUS, *grak'us*. A well-known Roman family bore the name of Gracchus. Several members of the family became prominent in state affairs.

Tiberius Sempronius Gracchus was twice consul. He was the husband of Cornelia and the father of two famous sons whom Cornelia always called her jewels.



CORNELIA AND HER "JEWELS"

A member of the noble Gracchus family, Cornelia once proudly pointed to her handsome sons, saying, "These are my jewels."

The two sons, referred to in history as the Gracchi, were **Tiberius Sempronius** (163-133 B. C.) and **Gaius Sempronius** (153-121 B. C.).

When Tiberius, the elder of the brothers, was elected tribune, he attempted to limit all individual landholdings to 500 acres of public land and to divide the remainder among the poorer classes, or plebeians. Years before, there had been a similar limitation under the old Licinian Law. The bill was passed after much opposition by the landholders, but Tiberius was killed during the next election.

Gaius, the younger brother, was elected tribune ten years later (123 B. C.), and he finally put the land laws into practice. Gaius was extremely popular with the people because of his liberal policies, particularly his grain laws. However, the nobles at last succeeded in overthrowing him.

GRACES. The ancient Greeks believed that three beautiful goddesses, named



NEW TREES FOR OLD

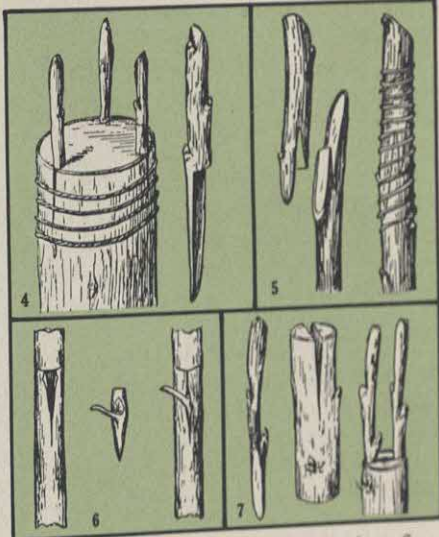
Scientists can now build a new fruit tree on the stump of another; even produce different fruits on a single tree. (1) New shoots on an apple tree. (2) Side graft. (3) Bridge grafting. (4) Cleft grafts. (5) Whip grafts. (6) Bud grafting. (7) Simple cleft grafting.

Aglaia, Thalia, and Euphrosyne, were the source of all beauty and pleasure. Known as the Three Graces, they were the daughters of Zeus, greatest of all the gods, and are mentioned in classical literature as the ones who brought happiness to the gods and goddesses. Sculptors and painters have depicted them always together, clasping hands, or embracing one another.

GRACKLE, *grack'l*. See CROW BLACK-BIRD.

GRAFT'ING. The processes of grafting and budding consist of inserting a bud or a limb of one tree into the stock of another so that the sap circulates through the new part and causes it to continue to grow in its new home. The part that is grafted into a tree or branch is called the *cion*; the part into which it is inserted is known as the *stock*; and the new growth is called a *graft*.

Purposes of Grafting. Usually, grafting is practiced on woody plants such as fruit trees, ornamental trees, shrubs, and vines. Many improvements can be brought about by grafting, including the growing of varieties that do not come true from seed, work-



ing over undesirable varieties, dwarfing trees, supplying missing branches, and equipping the plant with disease-resistant roots. Grafting will not improve the tree as a variety, nor will it produce a "cross" between two fruits, as many people believe. Both the cion and the stock remain unchanged as to variety.

Only closely related trees can be successfully grafted. Plums, peaches, apricots, and other stone fruits may be interworked. Apples and pears will usually interwork, but apple trees cannot be grafted upon



Courtesy Canada Steamship Lines

NO FAMINE HERE

Grain elevators, like the barns of Joseph, store the nation's supply of staple foods.

cherry or plum trees. Likewise a branch of a fruit tree cannot be grafted upon a shade tree; the difference between them is too great. All grafting works on the principle that the cion will reproduce its own fruits, regardless of what stock it is grafted upon (although it must be grafted to similar stock), and upon the principle that the sap will pass from the stock into the cion.

Kinds of Grafting. Grafting may take place at four different locations on a tree. *Root* grafting involves the uniting of only the root with the cion; in *crown* grafting the cion is inserted on the crown or collar at the surface of the ground; *stem* grafting occurs when the cion is inserted on the tree trunk below the limbs; and *top* grafting takes place only on the branches of the tree. In making the union, there are four generally used methods of inserting the cion: *budding*, *whip grafting*, *cleft grafting*, and *bridge grafting*.

Budding is used in the culture of young fruit trees and ornamental plants and consists of inserting the bud from the axil of a leaf into a T-shaped slit cut in the bark of the stock. The stock is then bound with yarn in a way to allow for expansion as the bud swells.

Whip grafting is accomplished by cut-

ting notches in both the stock and cion. These notches are then fitted together, bound with string, and covered with grafting wax. This method is commonly used in propagating young trees.

Cleft grafting is done by splitting a sawed-off limb and inserting one or two sharpened cions. The wound is then waxed for protection against air and moisture. This method is often used when trees are too large for whip grafting.

Bridge grafting is a means of repairing wounds in the bark of a tree. Cions are cut to bridge the damaged area, and both ends of each cion are sharpened and inserted between the bark and the wood, both above and below the damaged area. The tree then draws its sap through these new cions. Like other grafts, these must be bound and waxed until nature heals the joint.

GRAIL, THE HOLY. Many legends of the Middle Ages were based on the Holy Grail, the cup which Christ was said to have used at the Last Supper. One story was that the Grail was brought to England but was taken to Heaven because one of its keepers was sinful. Sir Galahad, purest of King Arthur's knights, was said to have made an earnest quest for it.

Two of Richard Wagner's great operas, *Parsifal* and *Lohengrin*, are based on a Grail legend, and Tennyson's *Holy Grail* in the *Idylls of the King* is founded on the search for the treasured cup. Lowell's *Vision of Sir Launfal* also deals with the Grail. See GALAHAD, SIR.

GRAIN ELEVATOR. Throughout the grain belt of the United States and Canada, lofty buildings called grain elevators may be seen. These structures are designed to handle, clean, and store grain. An elevator is usually rectangular in shape and rises several stories above the ground. Surmounting the structure is a cupola, which contains the machinery for weighing, moving, and cleaning the grain, although sometimes this mechanism is in the basement. If corn is handled, it must be shelled. The lower part of the building, built of wood,

steel, stone, or concrete, serves for storage.

If grain comes by truck, it is dumped into hoppers; if by railway car or boat, it is unloaded by an endless "bucket belt," inserted into the car or boat. This belt conveys the grain to the top of the elevator, where it is weighed and cleaned; it is then

sent down a chute to the proper bin or reloaded for further shipping.

The huge elevators at Superior, Wis., Kansas City, Mo., and Port Arthur, Ont., are among the largest in the world. Each of these has a capacity of 10,000,000 or more bushels.

GRAINS-*Plants of Prosperity*



GRAINS. Throughout the length and breadth of America, waving summer grains proclaim their promised wealth of autumn harvests. And indeed, no products of the field are of greater importance; not only do the farmer and his busy city cousin depend upon grain for their daily bread, but the

backbone of the entire livestock industry is based on it. Not without a great deal of knowledge, skill, and hard work is the great grain harvest assured each year.

Cereals, as grains are often called, derive their name from the Latin word *cerealis*, meaning *pertaining to Ceres*. Ceres was the Roman goddess of all growing vegetation.

What Are Cereals? Strictly speaking,

cereals are those members of the grass family which are cultivated for their edible seeds. They include corn, wheat, oats, rye, barley, rice, emmer, spelt, millet, and grain sorghums. In the United States, all except corn and the sorghums are termed "small grains." Emmer and spelt are small grains closely related to wheat. Buckwheat and flax, often called grains, are actually not of the grass family. In Europe and throughout much of the British Empire, "corn" does not mean maize, but refers to the "small grains."

Description of Grain Plants. The *roots* of grains branch out freely in all directions within a radius of one to three feet, though the roots of corn and the sorghums may reach a length of eight to ten feet in unusually dry periods.

The *stems* of grains have hard, solid joints called *nodes*, and cylindrical, hollow segments called *internodes*. Small grains have five to eight of these sections; corn and the sorghums often have from ten to twenty.

The *leaves* of the cereals are borne one at each node. The blades of the leaves are somewhat trough-shaped, pointed, and often twisted.

The *flowers* are popularly called *heads*, although in wheat they are often termed *spikes*, and in oats and rice, *panicles*. All except corn bear their heads in an upright position at the top of the stem.

The *seed* of grasses is not a true seed, but a special kind of nut or dry fruit, called *caryopsis*. It consists of a single seed enclosed in a thin-walled ovary, and in the case of small grains is boat-shaped, with a rounded back and creased belly. Corn has flat, triangular-shaped seeds.

For descriptions of the different grains, see separate articles on CORN, WHEAT, RYE, etc.

GRAM. This is the basic unit of weight in the metric system. It is equal to about .035274 ounce or 15.4324 grains. Ten grams, equivalent to a decagram, are equal to 5.644 drams or .3527 ounce. The other units of weight in the system are the hectogram (100 grams, equal to 3.527 ounces); kilogram (1,000 grams, equal to 2.205 pounds); and the myriagram (10,000 grams, equal to 22.046 pounds). One gram is equal to the weight of one cubic centimeter of water, while a kilogram is the weight of a liter of water. The gram is now used everywhere in measuring drugs and in chemistry.

"WHEN THE CORN IS IN THE SHOCK"

Long lines of corn shocks are symbols of prosperity at harvest time. These are the "soldiers" that stand guard against poverty and want.

Norfolk and Western Railway





ROMANTIC OLD SPAIN'S MOST ROMANTIC SPOT

The Alhambra Hill at Granada, where conquering Moors once ruled supreme, holding court at one of the most beautiful castles in the world—the Alhambra.

GRAMMAR. We all know that we must say “I have gone” and not “I have went,” but some of us may not know why it is that the first phrase is right and the second wrong. To know what is right, we must learn the rules of grammar, which teach us the correct way of speaking and writing our language.

Grammar may seem to be a dull, uninteresting subject, and sometimes you may think it an unnecessary subject, since you can tell by the sound of a sentence whether or not it is right. However, people who do not learn English grammar when they are children cannot tell by the sound of a sentence whether it is right, nor can those who have always spoken English be sure that they are speaking correctly unless they know the rules which grammar teaches. There are many times in life when it becomes very important for a person to say exactly what he means. Ability to express meaning clearly depends upon a knowledge of grammar.

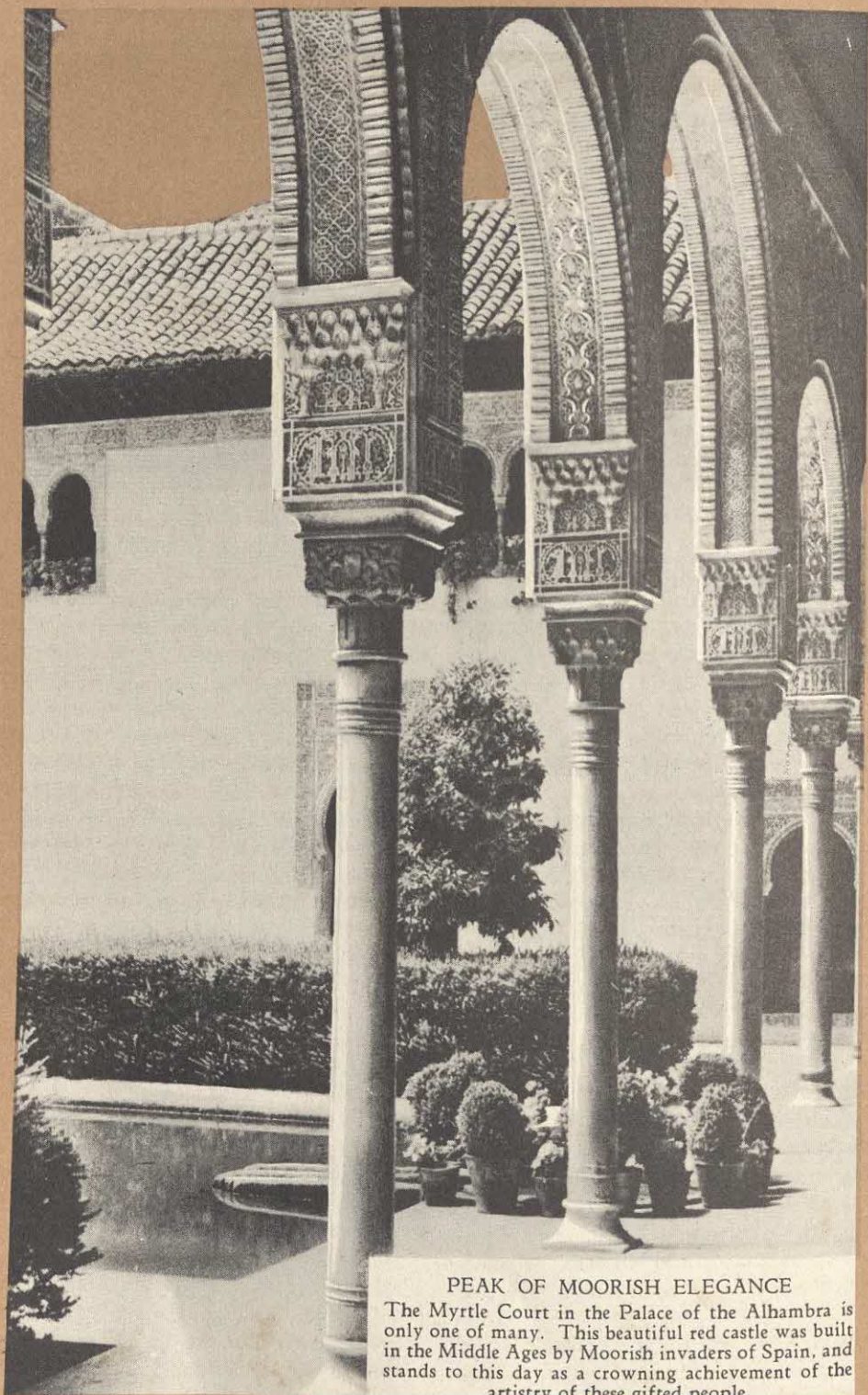
The rules of grammar are constantly changing, for our language progresses with our civilization. If we want to be in step with the world in which we live, we must know modern grammar.

There are two phases of grammar to be

studied. One phase, *etymology*, is the study of words; it includes the parts of speech, the conjugation of verbs, and the declension of nouns. The other phase, called *syntax*, is concerned with the proper relationship of words in a sentence; that is, the relation of the subject to the verb or the relation of words to their modifiers. See LANGUAGE AND GRAMMAR.

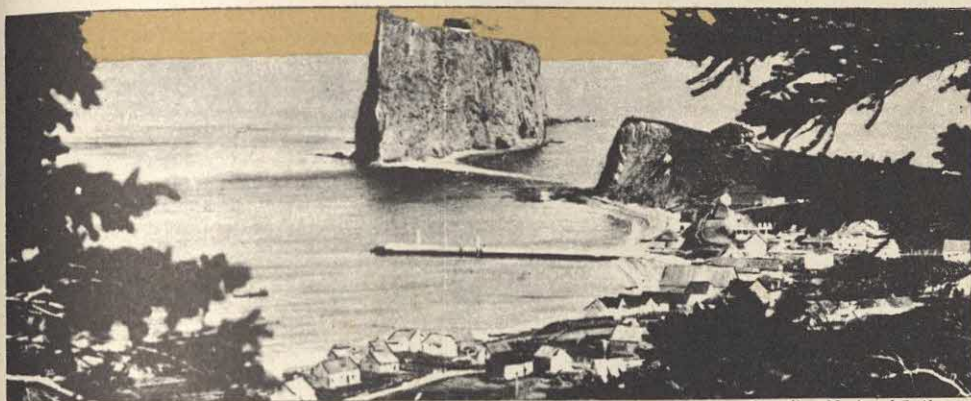
GRANADA, *gra nah' da*. Colorful Moorish courts, lavish with riches of the East, are associated with ancient Granada, a province of Spain. There, from the ninth to the fifteenth century, the dark-skinned Moors held sway, bringing their learning and culture to the beautiful and valuable country. During that period, Granada was a kingdom embracing the present provinces of Granada, Almeria, and Malaga, an area of 11,000 square miles. The area of the present province of Granada is 4,928 square miles. The kingdom, which covered an area of 11,128 square miles, was conquered by Ferdinand and Isabella in 1492.

Granada is important today for its olive trees and vineyards and its sugar cane, and for silver, zinc, coal, lead, and iron. Its capital is the city of Granada, a city as colorful as is the history surrounding it. Looming above its hilly streets is the magnificent



PEAK OF MOORISH ELEGANCE

The Myrtle Court in the Palace of the Alhambra is only one of many. This beautiful red castle was built in the Middle Ages by Moorish invaders of Spain, and stands to this day as a crowning achievement of the artistry of these gifted people.



Courtesy Canadian National Railways

BEAUTY SURROUNDS COTTAGES OF GRAND BANKS FISHERFOLK

A solemn and rugged grandeur exists for Grand Banks fishermen, home from the sea, in that easterly section of old Quebec known as the "Brittany of the New World."

Alhambra, the palace of the ancient Moors; this palace, the cathedral, and the Generalife (the summer home of the Moorish royalty) make the city a center of historic architecture.

Founded probably in the eighth century, the city became the capital of the kingdom in the thirteenth century, and at the height of its prosperity it had a population of 400,000 or more. As the kingdom of the Moors dwindled, the city of Granada became its last stronghold, finally succumbing to the Spanish forces in 1492. Its grandeur was unimpaired for many years, however, for the Moors were allowed to remain. But, when they were expelled in 1610, the city declined, leaving only its architectural and art treasures to remind its people of the glory that once was Granada. Its population is now about 171,000, and that of the province some 780,000.

GRAND ARMY OF THE REPUBLIC.

This patriotic society of Union veterans of the War between the States was founded at Decatur, Ill., on April 6, 1866. Anyone who had been honorably discharged from the North's army, navy, or marine corps could belong, as could veterans of state regiments that had been under Federal officers.

The G. A. R. was founded primarily for keeping alive the fraternal spirit among the veterans, perpetuating the memory of

those who had died during the war, and assisting veterans' dependents and needy members. It also encouraged the founding of many soldiers' homes, much pension legislation, and the observance of Memorial Day in the North.

Besides its national headquarters, the society organized state and territorial divisions and many local "posts." Membership reached a maximum of 409,489 and then began to decline, as death thinned the veterans' ranks. The final (eighty-third) annual encampment was held in 1949. See CONFEDERATE VETERANS, UNITED.

GRAND BANKS. Lying off the coast of Newfoundland are the shallow Grand Banks, to which thousands of fishing boats come each year to catch the plentiful cod, halibut, and other valuable commercial fish. Discovered by John Cabot on his expedition in 1497, the Grand Banks have since been the goal of fishermen of all nationalities. Extending about 300 miles along the coast, and 200 miles from land, is this undersea plateau, where the water is from 120 to 600 feet deep. The climate is affected both by the Gulf Stream and by the Arctic Current, and there are heavy fogs. This condition, together with the presence of icebergs, makes fishing a dangerous occupation. Fishing rights on the Grand Banks are held by Great Britain, France, Canada, and the United States.

GRAND CAN'YON OF THE COLORADO. Nowhere else in America and, in the opinion of some, nowhere else in the world, has Nature created such awe-inspiring, breath-taking scenery as that presented by the deep chasm carved by the Colorado River in Northwestern Arizona. As one stands on the brink of this mammoth gorge, the Grand Canyon of the Colorado, giant skyscrapers and the most stupendous of man-made creations become as toys, and the observer finds himself without words to express his amazement or to picture the marvel which lies before him. Nor can a camera reproduce its majestic beauty. To realize the magnificence of the Grand Can-

yon, one must see it.

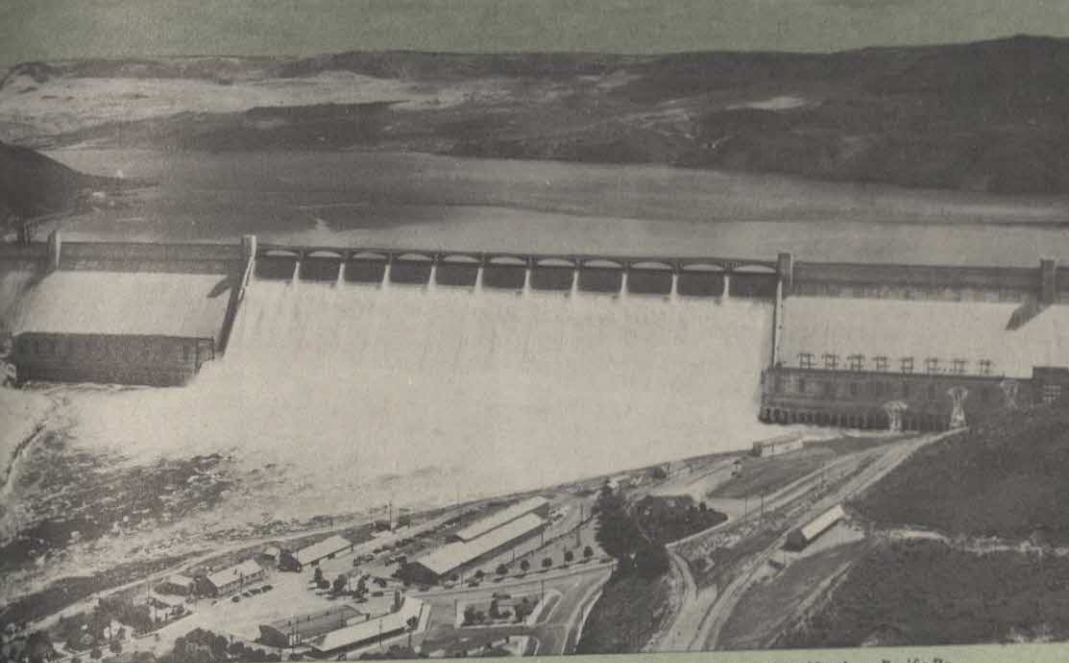
Over 200 miles long, averaging a mile in depth, and twelve miles in width at the top, the mighty spectacle bursts upon the visitor without warning. If he arrives at the southern rim, he has traveled for several hours across a flat and uninteresting country,

A RIVER'S MASTERPIECE

The magnificent Grand Canyon of the Colorado, probably the most inspiring of America's many natural wonders, was carved out of the rock by the rushing Colorado River. Visitors from all over the world have stood in awe on the brink of this vast chasm, watching the endless variety of changing colors and shifting light and shadow in the gorge below.

Credit: Union Pacific Railroad





Bureau of Reclamation; Northern Pacific Ry.

POWER AND PROSPERITY FROM THE MIGHTY COLUMBIA

Grand Coulee Dam on the Columbia River is a government project for reclaiming lands in the Pacific Northwest. It provides flood control, hydroelectric power, and irrigation.

partly wooded, and giving no hint of the unusual. Suddenly he is at the very brink of the chasm, speechless before its grandeur. Below him spread valleys and peaks, rough craggy cliffs, wide mesas, and queer rock formations of every conceivable shape. Add to this a fairy-like mingling of every known tint and hue—rich reds and yellows, whites, jet blacks, delicate blues, and rare purple and rose pastels—all blended into a symphony of color no artist's palette could produce; magically changing moment by moment as the sun follows his unchanging course across the heavens.

Peering over the brink, one views a narrow, winding ribbon of water, the Colorado River, at the very bottom of the gorge. Should the traveler be interested in making the descent to the water's edge, he may follow either the Bright Angel or the Hermit Trail. The trip may be made on foot or on muleback, and a full four hours are needed to reach the muddy, noisy stream. This world-famous, mile-deep chasm was formed as the Colorado River carved its way downward for ages, through the rocky Arizona

plateau. In 1919, about 958 square miles of the region were set apart as the Grand Canyon National Park. See COLORADO RIVER; PARKS, NATIONAL.

GRAND COULEE. High above the Columbia River, in the northwestern section of the state of Washington, lies this canyon—a large, empty gorge formed in prehistoric times by the river. As part of a Federal power project, the Grand Coulee Dam was built. It made of this gorge one of the world's great water reservoirs, forming a 151-mile long lake above the dam. See COLUMBIA RIVER.

GRAND JURY. See JURY AND TRIAL BY JURY.

GRAND RAPIDS, MICH. Famous throughout the United States as a center of furniture manufacture, second in size only to Detroit among the cities of Michigan, Grand Rapids lies in the center of a productive fruit-growing region. It is located on the Grand River, thirty miles inland from Lake Michigan, and is an important industrial and trading city. It is the county seat of Kent County. The population numbers

about 176,500; there are many Hollanders.

The first white settlement was established in 1826, on the site of a former Indian village. The city received its charter in 1850, and since that time it has had a steady growth. It was first important as a lumber center; logs cut from extensive forests of the region were floated down the Grand River to Lake Michigan, where there were several lumber mills. Later, mills were established in Grand Rapids, and they became the basis of an important furniture industry, once the largest in the country. Though now outranked in this respect, it is still often called the "Furniture Center of the United States."

Other manufactures include a wide variety of metal and paper products, chemicals, and textiles. Food processing, petroleum refining, and printing are important. The city's industrial development has been furthered by the cheap electric power derived from the rapids in the Grand River. Grand Rapids is also a shipping center for the produce of Western Michigan. Calvin and Aquinas colleges are located there.

GRANGE, *granje*. The National Grange of Patrons of Husbandry differs from all other farmers' societies in one respect—it is a secret order, like the Masons or Knights of Pythias. But it differs from other secret orders in that it throws open its membership to both men and women. It was established for the purpose of bringing men and women of the farm together, so that they might help each other in raising the standard of farm life and in promoting the interests of the farmer generally.

The Grange is especially strong throughout New England, New York, and the farming states of the West, but in the South the membership is not so large as in some former years. Many of the local Granges possess their own buildings, which in many cases serve the neighborhood as a sort of community center where all kinds of social affairs are held.

The Grange is the oldest of nation-wide American societies devoted to promoting the general interests of the farmer. It was

started on its way at a meeting of half a dozen employes of the United States Department of Agriculture, at Washington, D. C., in 1867. The first permanent local Grange was established at Fredonia, N. Y., and it is still flourishing.

GRANITE. Millions of years ago, the earth was covered with molten rock which was very similar to the lava that flows down from active volcanoes. As the earth's surface began to cool, the lava solidified and turned to igneous rocks. That which was deep below the surface cooled slowly, forming crystals. This type of rock is known as granite. It is composed principally of quartz, feldspar, and mica, and has a granular structure. It varies from fine to coarse-grained.

Of all the igneous rocks, granite is the most widely found, and is valued highly as a building stone because it is very hard and strong and is not affected by weather. It can be polished, and its variety of colors—white, gray, and nearly black, delicate pink or dark red—give buildings an attractive appearance. It is distributed widely in the United States, and can be quarried in large blocks, making it particularly desirable for buildings and monuments.

Most of the granite quarried in the United States comes from New England. Minnesota, however, has large granite quarries, as do California, Colorado, Wisconsin, and Wyoming. Valuable deposits, too, are found in Georgia; Stone Mountain, in this state, with its sculptured figures of Confederate soldiers, is a solid mass of granite.

Granite varies in composition, forming syenite when the mica is replaced by hornblende. Gneiss differs from granite in having a banded structure of its minerals. See GNEISS.

GRANT, ULYSSES SIMPSON (1822-1885). As general and as President, Ulysses S. Grant is one of the outstanding figures in United States history. Modest and sincere, yet unyielding when necessary, Grant was responsible in a large measure for the final victory of the North over the South in the Civil War; yet, uncompromising as he was

in wartime, it was his desire to effect a "peace without victory."

Grant is remembered today more for his military attainments than for his political career. Modern warfare is partly his invention, for with General William Tecumseh Sherman and General Philip Sheridan, he introduced the cruel but necessary element of present-day campaigning known as "breaking the enemy's will-to-war." It was his and Sherman's idea that by pillage and destruction, peace can be brought about more speedily than by long and arduous battles. This principle of warfare has been followed ever since in the great struggles of the world. His victories in the West and his campaign in the East, leading to the surrender of Lee, also are considered excellent examples of military generalship.

Born at Point Pleasant, Ohio, April 27, 1822, Grant was taken with his family to Georgetown, Ohio, when an infant, and grew to manhood in the neighborhood of Cincinnati. Although his real name was Hiram Ulysses Grant, he was enrolled at West Point as Ulysses Simpson Grant through a mistake of a Congressman. Grant used the name as his correct one from that time on. At West Point, Grant was an undistinguished student. He served in the Mexican War following his graduation, and was promoted to the rank of captain.

Resigning from the army in 1854, he became a farmer and real-estate salesman near Saint Louis; then, failing in these pursuits,

he became a clerk in his father's store in Galena, Ill.

Military Career. When the Civil War began, in 1861, Grant wrote to Washington, offering his services to the Union army;

but, since he received no answer, he joined a company of volunteers. He was chosen captain of the force, then was promoted to the rank of brigadier general. Assigned to military operations in the West, Grant was responsible for the seizure of Paducah, Ky. Marching southward, he took Forts Henry and Donelson, and triumphed at Shiloh. His next objective was Vicksburg, and on July 4, 1863, that strategic city fell after a long siege. Since the North had won major victories only in the West until July, 1863, Grant was becoming well known, and was



ULYSSES SIMPSON GRANT

Eighteenth President of the United States
Administrations, 1869-1877

Although he was a distinguished military leader and a popular national hero, Grant lacked the political experience and understanding to become an outstanding Chief Executive.

promoted to major general in the regular army. He was given complete command of the western operations, directing the Battles of Chattanooga, which opened up the South for Sherman's march.

Lincoln, sorely vexed with the generals of the Army of the Potomac, was pleased with Grant's record in the West, and, over the objections of several military advisers, appointed him to command the entire army in March, 1864. As lieutenant general, he worked out a plan with Sherman and Sheridan for simultaneous campaigns in the South, the Shenandoah Valley, and the Potomac that were to result in eventual victory. He personally commanded the Army of the Potomac, and led his men steadily



THE CIVIL WAR'S GREATEST STRATEGIST IN ACTION

General Grant's celebrated campaign in the Wilderness was relentless and terribly costly, but it led to ultimate success; it was followed next year by Lee's surrender.

southward in stubborn battles with Lee at the Wilderness, Spottsylvania, and Cold Harbor. Finally, Lee was trapped at Appomattox after Richmond fell, and the war ended. When Lee surrendered, Grant refused to take his sword, and instead of seizing the Confederate horses, he permitted the soldiers to keep them "for the spring plowing."

Eighteenth President (1869-1877). With the assassination of Lincoln, Grant became the hero of the North, and during the troubled years that followed immediately after the war, he was the most popular man in the country.

Although he had never been associated with politics, and had only voted once in his life, Grant was unanimously chosen as Republican candidate for President in 1868.

He was elected by a majority of 214 electoral votes over Horatio Seymour, the Democratic candidate. Four years later he was elected for a second term. During his first administration, the ratification of the Fifteenth Amendment, providing suffrage regardless of race, the passage of the Amnesty Act, giving the South civil rights, and the settlement of the *Alabama* claims were the principal events. His second administration was marred by a disastrous financial depression in 1873 and by political scandals. On the constructive side were the act abolishing the bimetallic system and the one providing for the resumption of specie payments.

Later Years. When his second term was over, Grant made a trip around the world, and later became associated with a business venture that failed. In order to rehabilitate

his finances, he wrote his *Memoirs*, which are highly valued today because of their fair and accurate notes on the Civil War. They were completed while he was dying of cancer of the throat.

Grant himself was a man of high ideals, but he was a weak man in the White House. His appointees were not of the highest character, and he permitted them to misuse their authority and public money. But Grant himself could never be accused of taking part in any act that he knew to be disgraceful.

For additional information, consult the following articles:

Civil War in America	Reconstruction
Credit Mobilier of America	Specie Payments
	Washington, Treaty of

GRAPE. The fruit of the vine has been a favorite of mankind from earliest times. Seeds of grapes have been found in the Swiss lake dwellings, showing their use in the prehistoric Bronze Age; and seeds have also been seen in Egyptian mummies thirty centuries old. After the flood, Noah planted a vineyard, as we read in the *Book of Genesis*. The ancients had their god of wine, called Dionysus by the Greeks, Bacchus by the Romans. Archaeology and literature both bear witness to the ancient and widespread use of this valuable fruit.

Growing on graceful vines that lend charm to lawn or garden, beautiful in form and color against their background of attractive foliage, grapes are sometimes cultivated as ornamentals and for shade, but their chief importance, of course, is their use for food and drink. Wine from grapes is the basis of a great industry in many parts of the world, and champagne, port, sherry, and other wines are universal favorites among fermented beverages. Unfermented grape juice is a popular and refreshing "soft" drink. As food, grapes are eaten fresh, are made into jams and jellies, and are dried as raisins. Fresh grapes have a high percentage of sugar as compared with many other fruits, and they contain beneficial acids. Artificial flavorings are made from acids found in the skins. Raisins and dried



TO EAT, TO CRUSH, TO DRY

Grapes are not only tasty fruit, but their juice is good. Fermented it makes wines. And raisins are sugar-filled grapes dried in the sun.

currants (small seedless raisins) are widely used in cookery (see **RAISINS**). The small dried grapes we know as currants came originally from Corinth, Greece, and were a valued food among the ancients.

Grapes are cultivated in north temperate regions throughout the world. They grow in the lowlands and at altitudes of 3,000 feet where conditions are favorable. A long, hot growing season is necessary for nearly all varieties. Spain is the leading country in acreage of vines. California leads all other states in acreage and production, and Ontario is the most important Canadian



GAY VINEYARDS IN SUNNY ITALY

When the grapes are ripe on the vines of Italy, peasant girls go out to gather them, singing the light-hearted "stornelli" folk song. The luscious fruit seems to embody the sun of the Roman Campagna.

province.

According to Icelandic literature, Leif Ericson visited the eastern coast of North America in the year 1000, and because he found grapes growing wild, he called the land Vinland, or "Wineland." Some think that Vinland may have been Massachusetts. At any rate, Concord, Mass., is the home of one of our most delicious and popular varieties—the blue-skinned Concord grape.

Grapes were introduced into California by the Franciscan missionaries in the latter part of the eighteenth century. The Franciscan Fathers used the *Vinifera* grape, a variety from the Old World, and found the Pacific coast well adapted to its culture. From this beginning developed the great California fruit and wine industry.

Wild grapes grow from seeds, but domestic varieties are planted by means of cuttings

or graftings (see **GRAFTING**). The seeds are contained within the pulp of the oval or round fruit, which grows in clusters. Grapes vary in color, being green, yellow, red, and purple; and in size they range from that of a pea to that of a walnut. The inconspicuous flowers of the vine are of a greenish color.

GRAPEFRUIT. The tree bearing this large, yellow fruit was a cultivated ornamental in Florida for many years before people found out how appetizing the grapefruit could be. Native to Southeastern Asia, the tree was brought to Florida in the sixteenth century by Spanish explorers, but it was late in the nineteenth century when Florida fruitgrowers began raising grapefruit for the Northern markets. Their name refers to their manner of growth, for the fruits appear in clusters, like grapes.



Photo by Burger Bros.

FIRST STEP ON THE ROAD TO THE BREAKFAST TABLE

The pickers climb high at harvest time in an orchard of grapefruit trees. The crop will be sold as fresh fruit, as canned segments, or in the form of juice — frozen or unfrozen.

Like other citrus fruits, the grapefruit has a decided tang. It is less sour than the lemon, but to some people it tastes bitter unless eaten with sugar. Especially popular as a breakfast fruit, it is also widely used in salads and desserts. Grapefruit juice is a refreshing beverage. Both pulp and juice contain Vitamin C, which prevents scurvy. Florida is the United States' leading grapefruit producer, but Texas, Arizona, and California also raise large quantities.

GRAPHITE, *graf'ite*. When we go to a store and purchase "lead" pencils, we really are buying pencils containing graphite. This soft, dark-colored mineral, which leaves a mark on paper and has the appearance of black lead, is a form of black carbon, and has the same chemical composition as diamonds and coal. It is found in nature in crystalline and non-crystalline forms, and is also manufactured in the electric furnace.

Graphite is a valuable substance, commercially. It is employed as a material for crucibles in which steel is melted, for it withstands very high temperatures. Natural

graphite is used for large crucibles, but the manufactured product serves all other purposes. In addition to the uses mentioned, graphite is employed in making lubricants, stove polish, paint for metals, glazing for powder, and hat dressings, and is used in electrotyping and for dry batteries.

The United States mines some graphite, but imports much more than it produces. Important producers include Ceylon, Korea, Japan, France, Norway, Madagascar, Mexico, Canada, Germany, Italy, and Soviet Russia.

GRASSES. Probably the most important family of plants in the world, so far as man is concerned, are the grasses, consisting of about 6,000 separate species, over 1,500 of which are found in North America. Upon this group of plants man depends to a great extent for food, because to it belong wheat, corn, barley, oats, rye, rice, and sugar cane, the latter "grass" furnishing fully one third of the world's sugar.

Animals, especially the domesticated kinds, feed upon the various species which we commonly think of as grasses, chief



Norfolk and Western Railway

STAFF OF LIVESTOCK LIFE

The grasses on grazing lands are essential to livestock raising. Flocks of sheep need a great acreage of grassland to feed upon.

among which are blue grass, timothy, and Bermuda grass. Many varieties are used as ornamental plants and for lawns. They also yield oils, and not a few are of value medicinally. The fibers of some grasses are made into paper and coarse clothing. In tropical lands, certain grasses also serve as thatching for house roofs.

Characteristics of Grasses. Grass stems are always jointed and nearly always cylindrical and hollow; but some times, as in corn and sorghum, the stems are solid. A few, like the bamboo, have woody stems.

The leaves of grass are arranged in two ranks, each leaf opposite and above the preceding one. The blade of the leaf is usually long and narrow, sometimes flat, but often rolled; and it is usually lined with parallel veins.

The flowers of grasses are usually called *florets*, and are arranged in small clusters named *spikelets*. As a rule, the spikelet of

grass appears at the top of the stem, although corn and sorghum are notable exceptions.

The fruit and seed of grass together are generally called grain, but in structure they are similar to a nut. All grasses reproduce by seed and are pollinated by a fine dust that blows from plant to plant, even in the faintest wind. They grow best in the temperate or torrid zones of the world. There are more varieties in the tropics, but a much greater total production in the cooler climates.

Consult the following titles for additional information:

Bamboo	Oats
Barley	Rice
Blue Grass	Rye
Cane	Sorghum
Corn	Sudan Grass
Gama Grass	Sugar Cane
Grains	Sweet Flag
Kaffir Corn	Timothy
Millet	Wheat

GRASS'HOPPER. A leaping insect often destructive to crops is the grasshopper. It has long, slender legs, the thighs of the hind legs being large and well developed. It is because of these strong hind legs that



HOPPING PLAGUE OF MAN

The destructive, short-lived grasshopper is one of the worst of all menaces to agriculture.

the grasshopper can jump such great distances in proportion to its size. This insect has two pairs of wings, one pair under the other. The top wings are long and extend back beyond the abdomen. One peculiarity of the male grasshopper is its ability to "sing" by rubbing together the wing covers.

The female lays her eggs in a hole in the ground in midsummer, and the young hatch in the spring. Before they mature,

the young shed their skins four or five times. Although the young are wingless for a few weeks, they strongly resemble the adults.

Grasshoppers are roughly classified as long-horned or short-horned. The long-horned kinds are the common green grasshoppers with long, threadlike antennae, or feelers. To the short-horned group belong the locusts, notorious as destroyers of crops. In some parts of the world grasshoppers are considered a delicate food. See LOCUST.

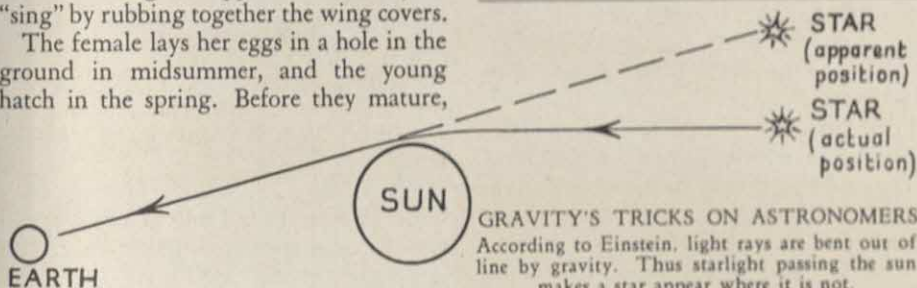
GRAVITATION, *grav i ta'shun*. For centuries, before they learned the truth, men had wondered why falling bodies fall toward the earth instead of away from it. They wondered, too, why the moon and the planets stay in their own orbits instead of crashing into one another or falling upon the earth or the sun. They did not know about the wonderful and strange force which we call *gravitation*.

Today it is believed that all matter attracts to itself all other matter. Two objects



GRAVITY FIGHTER

The high jumper fights gravity; it keeps down the height of his jump, brings him back to earth.



GRAVITY'S TRICKS ON ASTRONOMERS

According to Einstein, light rays are bent out of line by gravity. Thus starlight passing the sun makes a star appear where it is not.

on the ground, however, do not fly toward each other in spite of this mutual attraction because the force which attracts them toward the center of the earth is greater. Therefore, the two objects stay at their places on the ground. An object thrown into the air will fall back to earth because of the attraction, or force of gravitation, of the earth; but it is also true that the earth is attracted by the falling object. The earth wins in the struggle because its mass is much greater than that of the falling body.

For the same reason, the moon, being smaller than the earth, would fall upon us if it were not for the fact that it is kept where it is by the attraction of other heavenly bodies. Thus all the planets are kept away from the others by perfectly balanced forces.

In the seventeenth century, Sir Isaac Newton announced the general principle of gravitation. His law is that every portion of matter attracts every other portion of

matter with a force directly proportional to the product of their masses, and inversely proportional to the square of the distance between them. This means that if the mass of one of two bodies attracted to each other were doubled, the force of attraction would double; but if the distance between the two bodies were doubled, the force would be reduced to a fourth of its original strength. It is interesting to know that in the twentieth century, Einstein gives a different explanation of gravitation, although accepting Newton's law as mathematically correct for most cases. See EINSTEIN, ALBERT.

The term *gravity* is used to denote the attraction of the earth for bodies on its surface. Because the earth is widest at the equator, gravity is felt somewhat less than at the Poles, since the surface is farther away from the center.

The *center of gravity* is the point from which or on which a body is in equilibrium. The center of gravity in a marble is in the exact center of the marble. The center of gravity in an irregularly shaped object is not in the exact center, and such an object tends to turn about until its center of weight is as low as it can fall.

GRAVITY, Specific. The amount of pull that gravity exerts on a substance gives that substance its weight. The weight of a substance compared to the weight of an equal volume of a "standard" substance is called its specific gravity. Water at 4°C. or at 20°C. is the standard substance used in finding the specific gravity of liquids and solids, and dry air at 0°C. is the standard for gases. Since water is used as a standard, it has a specific gravity of 1. For example, a piece of tin will be found to weigh about 7.29 times as much as an equal volume of water; therefore its specific gravity is 7.29.

It will be seen that specific gravity is a relative quantity, while weight and volume are absolute quantities. For example, a quantity of water with a volume of 10 cubic centimeters weighs 10 grams. If a piece of iron having the same volume weighs 75 grams, the specific gravity of the iron is $75 \div 10$, or 7.5. That is, the piece of iron

weighs 7.5 times as much as an equal volume of water. There is a distinction between weight, volume, and density. In the case of the water and iron, the density is found by dividing 75 by 10, and the result is expressed as 7.5 grams per cubic centimeter. That is, density is the mass, or quantity of matter, contained in any given substance per unit of its volume. For a full explanation, see DENSITY.

The three general rules for finding specific gravity are explained below:

(1) In finding the specific gravity of a body heavier than water, first weigh it in the air; then weigh it suspended in water. The amount of weight lost in the water equals the weight of an equal volume of water. Subtract the weight of the body in water from the weight in the air and divide the weight in the air by the difference. The answer is the specific gravity of the substance.

(2) Finding the specific gravity of a solid object which is lighter than water can easily be done with the aid of a "sinker," an object dense enough and big enough to sink the light body. Find the weight of the sinker in air and in water and the weight of the light substance in air. Then attach the sinker to the substance and weigh the two together in water. Subtract the loss in weight of the sinker in water from the loss of the two bodies in water. This will give the loss of the light body. The specific gravity is obtained by dividing the weight of the light body by its loss of weight in water.

(3) The specific gravity of a liquid is found by using a specific-gravity bottle which holds a certain weight of water. By filling the bottle with a liquid of unknown specific gravity and dividing the weight of the liquid in the bottle by the weight of the water which the bottle will hold, the specific gravity is obtained. Hydrometers are also used in obtaining the specific gravity of liquids. See HYDROMETER.

GRAY, THOMAS (1716-1771). Master of beautiful and inspiring verse, Thomas Gray is one of England's best-loved poets. His *Elegy Written in a Country Churchyard*



WHERE A POET MEDITATED
Stoke Poges—churchyard of the *Elegy*.

ranks among the finest poems in the English language. Because of the type of poetry he wrote, Gray is considered the forerunner of the Romantic movement.

Most of his life was spent in London, the city of his birth, and in Cambridge, where he was educated. However, he did go to Italy for three years with his friend, Horace Walpole, son of the noted Prime Minister.

In 1757 he was offered the honor of poet laureate of England, but he declined to accept it. His ode, *The Bard*, is considered outstanding in English literature. *The Descent of Odin* and *The Fatal Sisters* are cherished by readers for their delightful treatment of old Norse mythology. Gray is likewise remembered as a writer of fine, interesting letters and excellent Latin verse.

GRAYLING, *grayling*. While the brook trout is without question the most popular fish of the streams of Northeastern United States and much of Canada, it meets a strong competitor or gives way entirely in Arctic regions or in the upper tributaries of the Missouri River. There, the grayling, a cold-water species, makes high claim to honors among game fish. It is closely related to the salmon family.

Graylings are most remarkable for the



BEAUTIFUL AND GAME

The grayling can be recognized by the large, handsome dorsal fin. Its flesh is tasty.

large fin on the back, which is often brightly colored. In the streams of North America are found the *Arctic* grayling and the *Montana* grayling. The *Michigan* grayling has become extinct. The grayling is an excellent food and game fish. It spawns in spring and early summer.

Graylings average from ten to twelve inches in length, but have been known to reach a length of twenty inches and a weight of two pounds in some instances.

GREASE. From the chemical standpoint, the name *grease* formerly applied to a mixture of three common glycerides, *olein*, *palmitin*, and *stearin*; in general, it is the name given any semi-fluid fatty or oily substance, whether obtained from animals, plants, or minerals.

Edible grease from animal and plant sources is used in cooking. Greases obtained from the distillation of petroleum are widely used as lubricants, called *cup grease* or *hard oil*. They resist much higher temperatures and are less expensive than lubricants from other sources. Commercially, grease is often incorporated with soap and resin oil to give it body. Graphite and, occasionally, ground mica are added for the same purpose. See PETROLEUM; OIL.

GREAT BEAR. See BEAR, GREAT.

GREAT BEAR LAKE. Situated in the Mackenzie District of Northern Canada, Great Bear Lake lies partly within the Arctic Circle and its waters are free from ice only three or four months of the year. The largest lake in Canada, it is irregularly shaped and has an area of about 11,200 square miles. Through the Great Bear River, it drains into the Mackenzie River, which flows to the Arctic Ocean.

[1756]

**CROWN SYMBOL.**

The Court of Saint James, named for this old Tudor palace, still designates the abode of British royalty. Left, palace sentry.

GREAT BRITAIN, brit'n. There is probably no other area of equal size in the world that contains so much wealth and activity as the small island composed of England, Scotland, and Wales, lying off the northwest coast of Europe. Throughout modern history, the influence of this small country has been felt in all parts of the world.

Northern Ireland, while not geographically a part of Great Britain, is included in the United Kingdom of Great Britain and

Northern Ireland. The total area of the United Kingdom, with the Isle of Man and the Channel Islands, is about 94,000 square miles. Population, about 52,000,000.

That Great Britain is noted chiefly as a commercial nation is due to the fact that it is centrally located in respect to the land masses of the world. A study of a commercial map of the world will reveal that all the important lines of trade join at this island. Lying between two important commercial bodies of water, the North Sea and the Atlantic Ocean, Great Britain has the advantage of being nearer to both North America and Europe than is any other country in the world.

The North Sea, which at the Strait of Dover is only about twenty miles wide, en-

ables the British to trade with neighboring nations. Before airplanes were developed, the sea served as protection in time of war. For this reason, Great Britain was able to defend herself with a strong navy. A huge standing army was unnecessary. The increasing use of planes and the later development of missiles sharply reduced the defensive advantage of the North Sea.

Surface and Rivers. Great Britain is a mixture of highlands and plains, which form several distinct geographical regions. There are no very high mountains, nor is there land lower than the level of the sea. The highest region of the island is in Northern and Central Scotland. The coast line of this region is rough and deeply indented. Because of its rough character, not many people live here, and transportation is difficult. South of this mountain region is a wide lowland in which many of the large cities of Scotland are located.

The southern part of Scotland, which is also a highland region, is noted for its large flocks of sheep, which supply a flourishing Scottish textile industry with wool. Extending down the western side of England from its northern border and into Wales is a long series of low mountain ranges.

Comprising almost all the eastern and southeastern portions of England is a plains region, which geologically is a continuation of the lowlands of Northern France. For in the past geologic ages, England was a part of the European continent, and the land that is now covered by the North Sea was a low land bridge over which the earliest people crossed into England. Later, this land settled and became covered with water.

Because Great Britain is small, there are no very long rivers. The largest are the Clyde of Scotland, the Severn of Southwestern England, and the Thames of Southeastern England. These streams drain large areas, and their wide, deep valleys make them valuable for shipping. Among other important rivers are the Trent, Tyne, Forth, Tay, Dee, and Don.

Great Britain's long and deeply indented coast line has been an important factor in

the development of her ocean trade and transportation. From the earliest times the British have been a seafaring people, and shipbuilding and fishing were among the first important industries. Britain's deep and commodious harbors, many of which are formed by drowned river mouths, have aided the development of shipping; and most of the harbors can accommodate even the largest ocean vessels. Shipping, however, is handicapped by the high tides, which make it necessary to build special docks in which vessels are kept when the tide is out.

Climate. The mild and stimulating climate is due chiefly to the warm prevailing westerly winds that blow in over the Gulf Stream. Although there are frequent changes of weather, there are not the extremes of temperature that occur in other countries. The winters are cold, but outdoor work is never interrupted, nor do the rivers and harbors freeze over. The summer temperatures are much cooler than those in the United States. The rainfall, although heavier in the western regions, is sufficient for all parts of the country and is evenly distributed throughout the seasons. The warm, damp Atlantic winds bring dense fogs which hover over the lowlands for days at a time.

Agriculture. Although Great Britain is noted as a manufacturing country, its agricultural industry is very important. Farming was in early times the leading occupation; and before the Industrial Revolution the country produced an abundance of food, enough to export as well as to supply the needs of the people at home. However, because of the tremendous increase in population and the development of manufacturing, Britain now depends largely on an imported food supply. The mild climate and fertile soil favor farming. The principal crops are grains, pasture grass, sugar beets, fruits, and vegetables. Farm land not suited to crops is used for the raising of sheep, cattle, pigs, and poultry. Since farm land is scarce in Britain, farmers use intensive cultivation.

Minerals and Manufactures. Extensive deposits of iron and coal are found in the upland regions of Western and Northern England and in the south of Scotland; and around these deposits are built the manufacturing districts. The tin mines of Cornwall have been worked intensively since the earliest times; although they are still an important source of supply, Britain must import much tin. There are a few copper deposits in the south of England, but additional copper is imported. Zinc, lead, and bauxite also are mined. Petroleum is imported.

As a colonial power, Great Britain naturally became a leading manufacturing country after the Industrial Revolution. It used its natural resources and large supply of manpower to manufacture goods that were needed in the colonies. The greatest proportion of the population still makes its living in the factories of Britain. The most important products include textiles, autos, trucks, airplanes, glassware, electrical goods, chemicals, fertilizers, processed foods, plastics, and articles of leather and wood. British textiles are of a very high quality and they are an important item of export, purchased by many countries.

Trade and Transportation. Because of Great Britain's need for the products and raw materials of other countries, she has developed a world-wide commerce. There is hardly an ocean port that is not visited by British boats loaded not only with her own articles of export and import, but also with the goods of other nations; for Britain has been known as a carrier of the world's goods. A large part of Britain's commerce was with her numerous colonies. Since the beginning of the Industrial Revolution, when a merchant marine was built to carry the products of the factories to world ports, Britain has been a leader in ocean commerce, with great fleets of merchant vessels carrying manufactured goods to all parts of the globe and bringing back raw materials for the mills and factories. British shipping suffered terrible losses in both World Wars, but in each case the return

of peace brought about the rebuilding of the merchant service.

The huge costs of World War II seriously damaged Britain's economy, and at mid-century the country was struggling to improve the balance of its imports and exports by cutting down on purchases abroad and increasing production for export. Because of production difficulties, coal — long a leading export — was in short supply. Raw materials and foodstuffs of many kinds had to be imported to meet the needs both of manufacturers and consumers. Britons at home did without in order to bolster the sale of British iron and steel products, machinery, textiles, and other manufactures abroad.

From the middle of the nineteenth century until after World War I, Great Britain, because her very existence depended upon commerce, operated on a basis of free trade. The depression of the 1920's put an end to this system, however, and duties were placed in imports. Special preference is given to members of the Commonwealth.

In the past, Great Britain's small but navigable rivers served as the most important means of transportation within the island. Before the coming of the railroads, many of the rivers were improved and canals were built, which connected the inland towns with the sea. The first railroad was built about the middle of the nineteenth century, and from that time on, the canals were of secondary importance. Now the Manchester Ship Canal and the Caledonian Canal are the most important. The railroad system is one of the most modern in the world, with more than 20,000 miles of track. The highway system is of historic interest, for many of the 200,000 miles of modern roads follow routes laid down by the ancient Romans.

Religion. Although England and Scotland are closely connected politically and economically, the people of the two countries differ in their ways of worship. In Scotland the established church is Presbyterian, and in England it is the Church of England. The Church of England in

Wales was disestablished in 1914. The people of Great Britain, however, are allowed to worship as they please, and there are large groups that attend the other Protestant churches and the Roman Catholic Church.

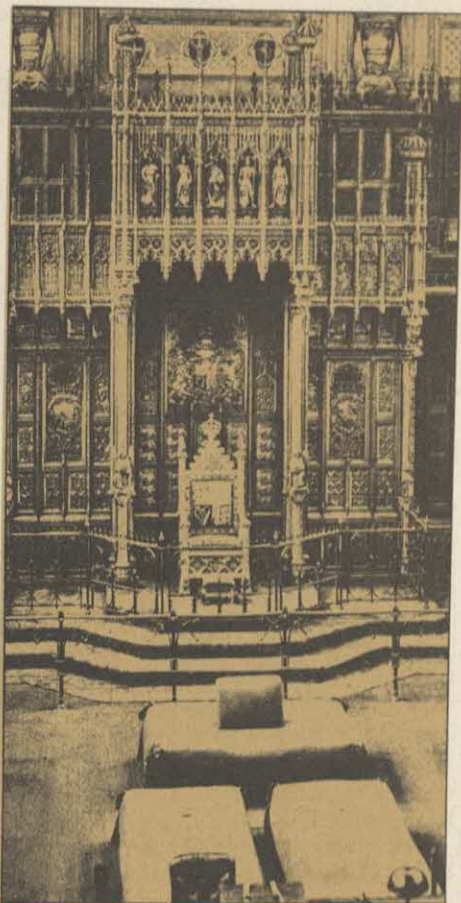
Education. See articles on ENGLAND, SCOTLAND, and IRELAND.

Great Britain's Army and Navy. From the time of the passing of the Bill of Rights in 1689, Great Britain's army has in peace times been composed of volunteer soldiers. According to that act, no king could maintain a standing army in peace times without the approval of Parliament. The land forces in times of peace consist of the regular army, territorial army, and reserves. During World Wars I and II, conscription laws were passed, and in the period of international tension after World War II a program of compulsory military training was continued.

More important to Great Britain's defense is her navy, which for centuries made the country the "mistress of the seas." Britain is a seagoing nation, and her navy, as well as her merchant marine, is usually among the world's largest. Under the Washington Treaty of 1921, her naval strength was reduced; but a build-up followed the Treaty of London of 1936, and Britain's fleet was a powerful force in World War II.

The Royal Air Force is the third arm of Britain's defense. With the ground forces and the navy it was a strategic factor in the plans laid at mid-century for defending the democracies of the West against Communist aggression. Britain shared in the atomic research carried on during World War II and developed its own atomic weapons in later years.

How Great Britain Is Governed. Great Britain is a constitutional, hereditary monarchy, headed by the king, the Cabinet, the House of Lords, and the House of Commons. Unlike that of the United States, the Constitution of Britain is largely unwritten and has developed through centuries of precedent. It is not a single document, but



IN THE HOUSE OF LORDS

The Woolsack, official seat of Britain's Lord Chancellor, and the King's Throne are shown.

is made up of the various acts of Parliament, maxims, and agreements from the Middle Ages to the present time.

However, there are several agreements and acts that constitute the most important parts of the Constitution. The first of these is the Magna Charta, by which King John surrendered certain rights to the people in 1215. Other important parts are the Declaration (or Bill) of Rights issued in 1689, the agreement uniting England and Scotland in 1707, and the Act of Union with Ireland in 1800. These acts, together with a mass of precedents followed for centuries, make up a Constitution which has the force



**MINSTREL AND
HOME OF
SCOTTISH
STORY TELLER**

Kilted bagpiper plays Scotland's national instrument. Sir Walter Scott lived on this estate at Abbotsford.

of written law.

The House of Commons and the House of Lords make up the legislative branch of the government. There are 625 members in the House of Commons, representing the counties and boroughs, and they are elected by popular vote for a term of five years. No member is required to reside in the district from which he is elected, and, as a result, a man valuable to the government may be assigned a "sure" district far from his own home. English and Scottish peers, priests, and other clergymen, and certain other persons are not allowed to become members of the Commons.

With a membership of more than 800, the House of Lords is composed largely of hereditary peers. There are also sixteen Scottish peers, chosen by the Scottish nobles for the term of Parliament; some Irish peers; two archbishops and twenty-four bishops of the Anglican Church; judi-

cial members of the Lords of Appeals in Ordinary; and new peers chosen by the king. The leader of the House of Lords is the Lord High Chancellor. Most of the members of both houses are men, although women have been admitted since the passage of a bill in 1918 giving them the right to sit in Parliament.

Parliament must, according to law, meet at least once every three years. However, it usually meets every year. All taxation and appropriation bills must originate in the House of Commons; and, up to the passing of the Parliament Act in 1911, every bill, before it could become a law, had to have the consent of both houses. However, since that time a money bill may become law without the approval of the House of Lords; and a public bill that has passed three readings (one in each of three sessions of the House of Commons) can become a law without such approval.

The king represents the executive branch and holds all powers not definitely forbidden by Parliament. Although the Crown is hereditary, the requirements for the ruler are that he must be a member of the Church of England and must be eighteen years of age before he exercises royal powers. The heir to the throne is the eldest

child of the king, although there is usually a preference for a male heir. The heir to the throne inherits the title of Duke of Cornwall and is granted the title of the Prince of Wales.

The king has the power to summon and dissolve Parliament, to declare war, to negotiate treaties, to issue passports, to appoint, promote, and remove civil officers, to appoint the high clerical officers of the Established Church, and to grant pardons. Although he has the power to veto all measures passed by Parliament, no king has exercised this power since 1707.

The king does not wield his powers directly, but through a ministry selected from the members of Parliament who belong to the political party that dominates the House of Commons. The king chooses the leader of the majority party to be Prime Minister, and he, in turn, chooses the members of the Cabinet from his own party. These ministers may be members of either the House of Lords or the House of Commons. The size of the Cabinet has increased over the years, and the total membership is around twenty. Besides the Cabinet ministers, there are a number of ministers who do not have Cabinet rank.

The duties of the ministers are to push the adoption of certain legislation, defend the government's policies, initiate legislation, and lead the majority in debates. If the ministers are defeated on any important measure, or if the House of Commons indicates lack of confidence in them, they resign. If, however, they think they still represent the majority opinion, they ask the king to dissolve the House and call for a new election. If they are defeated in the election, they must resign as a group. The ministers, aside from their legislative duties, also act as heads of departments.

The judicial branch of the government is headed by the House of Lords and the judicial committee of the Privy Council. The House of Lords sits as a criminal court when trying peers, as a court of impeachment, and as the highest court of appeals. In hearing an appeal, the court

is made up of the Lord High Chancellor, five judicial members, and members who have formerly held high judicial positions. In addition, there is the High Court of Justice, made up of three sections: the Chancery Division, the King's Bench Division, and the Probate, Divorce, and Admiralty Division. There is also a Court of Appeal, consisting of eight judges. Criminal cases are handled by the justices of the peace, the assize courts, and the Central Criminal Court in London.

Because Great Britain has come through centuries of development, there have been many changes in the form and rule of local governments, which have become very complex. The country is divided into counties, which include boroughs, urban districts, rural districts, parishes, and school districts. Each county has several elected officers, including the lord lieutenant, the sheriff, the justices of the peace, the clerk, and the coroner. There is also a County Council, elected by vote of the people, composed of councilors and aldermen. Their duties are to administer and manage local affairs.

Within the counties are the urban and rural districts, which are made up of a number of parishes. The districts are governed by assemblies elected by the parishes, and their duties include the administration of poor laws, public health, and the maintenance of highways. The parish also has an assembly composed of the eligible voters living within it. Rural parishes with more than 300 people also have a council that administers local matters. The towns, or boroughs, are governed by a mayor, aldermen, and a council. The members of the council are elected by popular vote, and they in turn elect the aldermen and the mayor.

London was made an administrative county with its own officers by the Local Government Act of 1888. The city is divided into twenty-eight boroughs, each with its own mayor, aldermen, and council.

History. When James VI of Scotland became king of England as James I in



CARNARVON CASTLE, WALES

Ancient customs and language give the principality of Wales the flavor of a foreign land.

1603, both countries came under a single rule. However, each country retained its own Parliament. It was not until 1707, however, during the reign of Queen Anne, that Scotland really became united with England and Wales under the name Great Britain.

Upon the death of Anne in 1714, George I became king. Although he came to the throne through the aid of the Whigs, he was forced to relinquish many royal powers to that party, which remained in control for more than fifty years. George I was a member of the German House of Hanover and was unable to speak English. He was an unpopular ruler and soon encountered difficulty when the supporters of the Stuart family, who had been exiled, staged a series of uprisings. George was interested only in his affairs in Hanover and was indifferent to his British subjects. As a result, the new Parliament established

the first Cabinet government under the leadership of a Prime Minister and also extended its own term of office to seven years.

Walpole became the first Prime Minister and held office for twenty years, although he did not actually have the title. It was under his leadership that England was able to withstand the panic caused by the failure of the South Sea Company. He retained his position under George II, who came to the throne in 1727 upon the death of his father, George I.

Walpole resigned in 1742 after three stormy years which began when England entered into a war with Spain. Under Pelham, Great Britain became engaged in the War of the Austrian Succession. During the war the country was further upset by new insurrections by the followers of the Stuart family. The revolution was finally put down, and its leader Charles Edward fled the country. Because of the policy of William Pitt, who became Prime Minister in 1757, England became involved in the Seven Years' War (1756-63). Although this war began badly for Great Britain, through Pitt's efforts it became the most profitable that the country ever fought.

While the war was in progress, George III came to the throne, in 1760. His accession marked a new era in the Crown's policy. Although George III was determined to be a real king, he was unable to maintain a strong government. Pitt and Bute were followed eventually by Lord North as Prime Minister. It was North's disastrous policy that lost Great Britain the American colonies.

William Pitt, the younger, became Prime Minister in 1783, and under his leadership Great Britain grew to be one of the most powerful nations in Europe. In a war declared against France in 1793, Great Britain's victory gave her a position of influence in the Congress of Vienna. After Pitt's death in 1806, Great Britain was faced with many social problems which were not solved until after the death of George III in 1820. The huge debt, piled up by the wars,

an unsuccessful revolution in Ireland, and a discontented populace made it necessary to make several far-reaching reforms.

When George Canning became foreign minister under George IV in 1822, he began a policy of reform that resulted in several minor improvements. Upon Canning's death in 1827, Wellington, a Tory, was appointed to head the government. Under him the reform policy was continued, which resulted in the granting of freedom of worship to Irish Catholics. During the reign of William IV (1830-37), reform reached a climax in 1832 with the passage of the Reform Bill. In the following year, slavery was abolished in Great Britain's colonies.

When, in 1837, Queen Victoria began her long reign, Great Britain entered one of the most prosperous periods in her history. So distinctive and outstanding was this period that it is known as the Victorian Age, for art, fashions, and literature reflected the tastes and attitudes of the British queen. The country was fortunate in having a series of capable ministers, including Peel, Palmerston, Disraeli, and Gladstone, to lead the government. With the repeal of the Corn Laws in 1846, Great Britain became a free-trade country.

In 1858 India became a part of the British Empire; and in 1876 Victoria became the Empress of India. Among the notable events of the Victorian Age were the Crimean War, 1854-56; the Reform Act in 1867, which increased the number of voters; the act of 1869 which released Irish Catholics from supporting the Anglican Church; and Britain's gaining control of the Suez Canal in 1875. Great Britain's colonial empire was expanded by the extension of control in Egypt and the South African War of 1899-1902.

Upon the death of Victoria, in 1901, her son, Edward VII, came to the throne. During his reign attention was mainly directed to domestic affairs, and a liberal policy toward social problems was generally accepted. A greatly increased tax on land was necessary to support many of the new



CAPITAL ON THE RIVER LAGAN

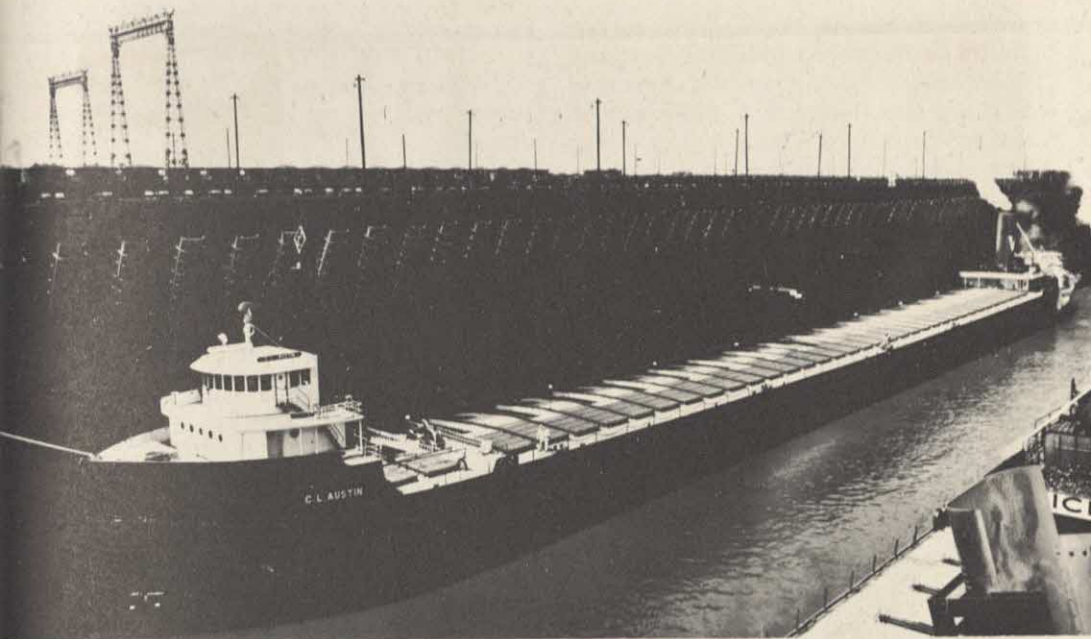
Handsome metropolis of Northern Ireland, Belfast has produced its share of gifted men.

measures, and the budget introducing this tax met with fierce opposition. The House of Lords refused to pass the budget in 1909, and it was not until after the death of King Edward in May, 1910, that it was approved and signed by George V, the new king. This obstruction by the House of Lords resulted in a bill that outlawed its power to veto legislation approved by the Commons. Under Prime Minister Asquith, a program of social reform was continued.

Great Britain entered World War I in 1914 allied with France, when Germany violated the neutrality of Belgium. Lloyd George became Prime Minister in 1916 and remained in power for six years. In 1922 the Conservative party gained control of the government, which it held for several years, except for an interruption of a few months in 1924 when the Labor party under Ramsay MacDonald came to power. With the fall of the MacDonald ministry, Stanley Baldwin was asked to form a Cabinet. He remained in office until 1929, when MacDonald again became Premier.

Great Britain inaugurated a new policy toward her colonies, when in 1926 she

Sea Lanes of an Inland Empire



Jones & Laughlin Steel Corporation

GIANT GREAT LAKES FREIGHTER LOADS IRON ORE

Broad water "highways" of mid-America carry the shipping of states, provinces, and the world.

GREAT DANE. Strong, courageous, and speedy, the Great Dane is the Apollo of dogs. It goes by several names but everywhere is recognized as a "superdog."

Great Danes weigh more than 100 pounds and stand thirty inches high at the shoulder. Favored colors are yellow with black cross stripes, yellow with black head, steel blue, and glossy black. They are long-legged and short-haired. They have pointed ears, blunt muzzles, strong necks, and heavy, high shoulders.

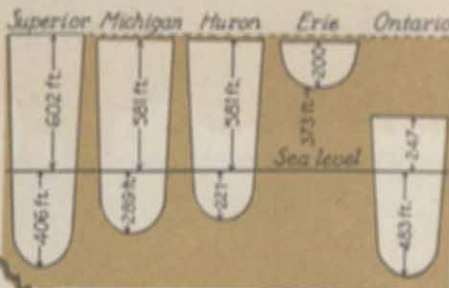
The breed was developed in Germany late in the 1700's. The dogs were used to hunt wild boars. Drawings of dogs resembling the Great Dane were found on Egyptian monuments of 3,000 B.C., but the breed is believed to be a cross of Irish wolfhound and English mastiff. Germans call the breed *Deutsche Dogge*, Italians call it *alano*, or mastiff. Properly trained, Great Danes make excellent pets but they require plenty to eat and ample exercise. See Dog.

GREAT LAKES, THE. There are probably no other inland bodies of water in the

world so important to trade and commerce as are the Great Lakes of North America. Lying next to the richest agricultural and manufacturing region on the continent, these five lakes, Superior, Michigan, Huron, Erie, and Ontario, carry almost as much commerce as is carried on all other American waters. They are situated between the United States and Canada and comprise an area of about 95,000 square miles.

The Great Lakes tilt to the east and drain into the Atlantic Ocean through the Saint Lawrence River. Lake Superior, the westernmost lake, is 600 feet above sea level and drains into Lake Michigan and Lake Huron, both of which are twenty-one feet lower. These lakes in turn drain into Lake Erie, which is eighteen feet below their level. The greatest drop occurs at Niagara Falls, where the waters of Lake Erie plunge down 326 feet into Lake Ontario. The Great Lakes are largely fed by underground springs, and no large rivers flow into them.

The commercial development of the United States has been due largely to the Great Lakes. After the opening of the Erie Canal in 1825, thousands of settlers passed through the canal to Buffalo on Lake Erie. From here they traveled by boat to the



SHIP HIGHWAYS

The 95,000 square miles of the Great Lakes form the world's largest body of fresh water, ranking high in commercial importance. Top, diagram of the depths and levels of the five lakes. Left, how they are arranged. Lower left, a picturesque lighthouse for safety of lake shipping.

Iron ore from some of the world's most valuable mines located to the west of Lake Superior makes up much of the tonnage on the lakes. A special type of vessel, made for carrying bulky goods, transports millions of tons of ore to the steel mills at the south end of Lake Michigan and to the ports of Ashtabula and Erie for transshipment to the mills at Pittsburgh. Each fall after the Canadian wheat has been harvested, hundreds of light-draft boats carry the grain from Port Arthur to the grain ports on Georgian Bay, to Buffalo, and to Montreal. Fruits and vegetables from the fertile farms along the shores also make up an important cargo.

The St. Lawrence Seaway greatly increased the distances that ocean-going vessels can travel on the Great Lakes. Previously restricted to Montreal in their westward travel, large ships now go directly from European ports to such cities as Buffalo, Toronto, Cleveland, Detroit, Chicago, Milwaukee, Toledo, and Duluth. This direct link to overseas commerce greatly increased the volume of business done by these Great Lakes ports, particularly Chicago.

Other canals built to facilitate shipping include the Sault Sainte Marie and the

West. Many of the people who settled in Illinois and Wisconsin arrived by way of the Great Lakes. Before the coming of the railroads, these lakes afforded the settlers the only means of getting their products to Eastern markets.

On the shores of the Great Lakes are located some of the greatest industrial cities in the United States. Duluth, Chicago, Milwaukee, Detroit, Toledo, Cleveland, and Buffalo owe some of their prosperity to the fact that they are lake ports, and every year these cities ship thousands of tons of manufactured goods and raw materials to the East and to overseas ports via the lakes and St. Lawrence Seaway.



BUSINESS AND PLEASURE ON A LAKE
On Michigan's southwest shore, Chicago, America's second largest city, has grown great. And on the beaches frolic many gay swimmers.

Welland. The Sault Sainte Marie allows vessels to pass from Lake Superior through Saint Mary's River into the lower lakes. The Welland Canal goes around Niagara Falls, connecting Lake Erie and Lake Ontario. Before the Saint Lawrence Seaway was completed, a canal system along the Saint Lawrence River allowed small ships to pass around the rapids in the river.

GREAT SALT LAKE. This large lake in Northwestern Utah is a very safe place to swim because it contains so much salt that it is difficult to sink. Located about 4,000 feet above sea level, the lake is 75 miles long and from 20 to 25 miles wide. In places the salt has become solid forming a roadbed and several islands. About 40,000 tons of salt are mined each year. The lake long ago covered about 20,000 square miles. This ancient geologic lake was named Lake

Bonneville after Benjamin Louis de Bonneville, an early explorer. Weber, Bear, and Jordan rivers empty into Great Salt Lake.

GREAT SLAVE LAKE. Lying to the south of the Arctic Circle in the cold, wind-swept plains of Northwestern Canada, is Great Slave Lake, more than 300 miles long and about fifty miles wide. It receives its water from several surrounding lakes, including Lake Athabasca, through the Great Slave River, and drains into the Arctic Ocean by way of the Mackenzie River. Great Slave Lake is frozen for half the year. Its shores are rugged and deeply indented, and the river contains many islands. The total area is 9,770 square miles.

GREAT WALL OF CHINA. Stretching like a gigantic snake across the northern boundary of China, for about 1,500 miles from the sea to the borders of the Gobi

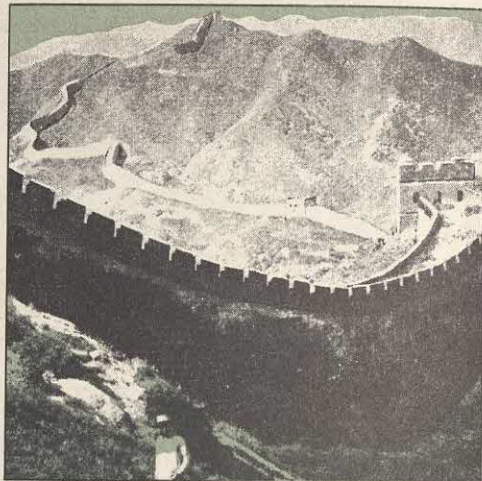
Desert, is a tremendous wall that represents one of the greatest engineering feats the world has ever known. It was begun in the third century B. C. by the Chinese emperor, Shih Hwang, in order to keep out the fierce tribesmen who swept down into China from the broad plains of the north.

The first wall was made of earth embankments, which crumbled and fell away under the rains and snows of centuries. Finally it disintegrated to a point where it no longer served as a defense. The ruler of the Ming Dynasty began to rebuild the wall in the fourteenth century. Slowly and painstakingly, thousands of Chinese laborers set stone on stone, and after more than 100 years of almost continuous work, the wall was completed.

The wall was built of brick and granite stones which were laid in parallel lines and filled in with earth and stones. Broad at the base, and about twenty-five feet wide, it tapers to a width of fifteen feet at the top, along which runs a path about ten feet wide. Every few hundred yards there are lookout towers more than forty feet in height. Although portions of the structure fell before the armies of the Japanese in 1937, the Great Wall has justified the centuries of work that were required to build it, for it has stood for almost five centuries, and even today hundreds of miles of it are intact.

GREBE, *greeb*. This curious, ducklike bird has lobed toes, a straight bill, small wings, and no visible tail. Its legs are so far back on the body that the bird is awkward on land and it is none too happy in the air. But in the water it has few equals, and the rapidity of its actions have won for it the common names of *hell-diver* and *water witch*. It has the habit of swimming long distances under water, or with only the tip of the bill above the surface, and it often escapes capture in this manner when closely pursued.

Several species of grebes are found in North America, of which the best known

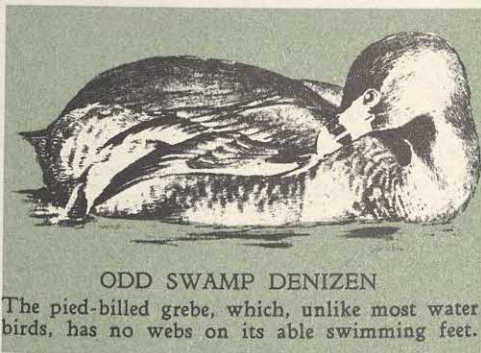


Publishers' Photo Service

FIRST LINE OF DEFENSE

Centuries ago, a Chinese emperor built the Great Wall. Today, armies and airplanes pass through and over it.

is the *pied-billed grebe*, or *dabchick*. It is a little over a foot long, dull brown in general color, with light underparts. As is true of most grebes, its head is more brightly marked in summer, this species then having a black throat and black band



ODD SWAMP DENIZEN

The pied-billed grebe, which, unlike most water birds, has no webs on its able swimming feet.

on the bill. The pied-billed grebe breeds from the Argentine Republic in South America to Central Canada, and winters from the Central United States and Potomac Valley southward; two of the other species do not go south of the Gulf of Mexico. The nest is built like a raft on the surface of water, sometimes entirely afloat. The young are curiously marked and can swim from the first.



